ORKG: Describing Papers Manually and Creating an ORKG Comparison

Oliver Karras, Alessio Ferrari, Davide Fucci, and Davide Dell'Anna

oliver.karras@tib.eu, alessio.ferrari@isti.cnr.it, davide.fucci@bth.se, d.dellanna@uu.nl

32nd IEEE International Requirements Engineering 2024 Conference – Exploring New Horizons: Expanding the Frontiers of Requirements Engineering

June 24th, 2024, Reykjavik, Iceland

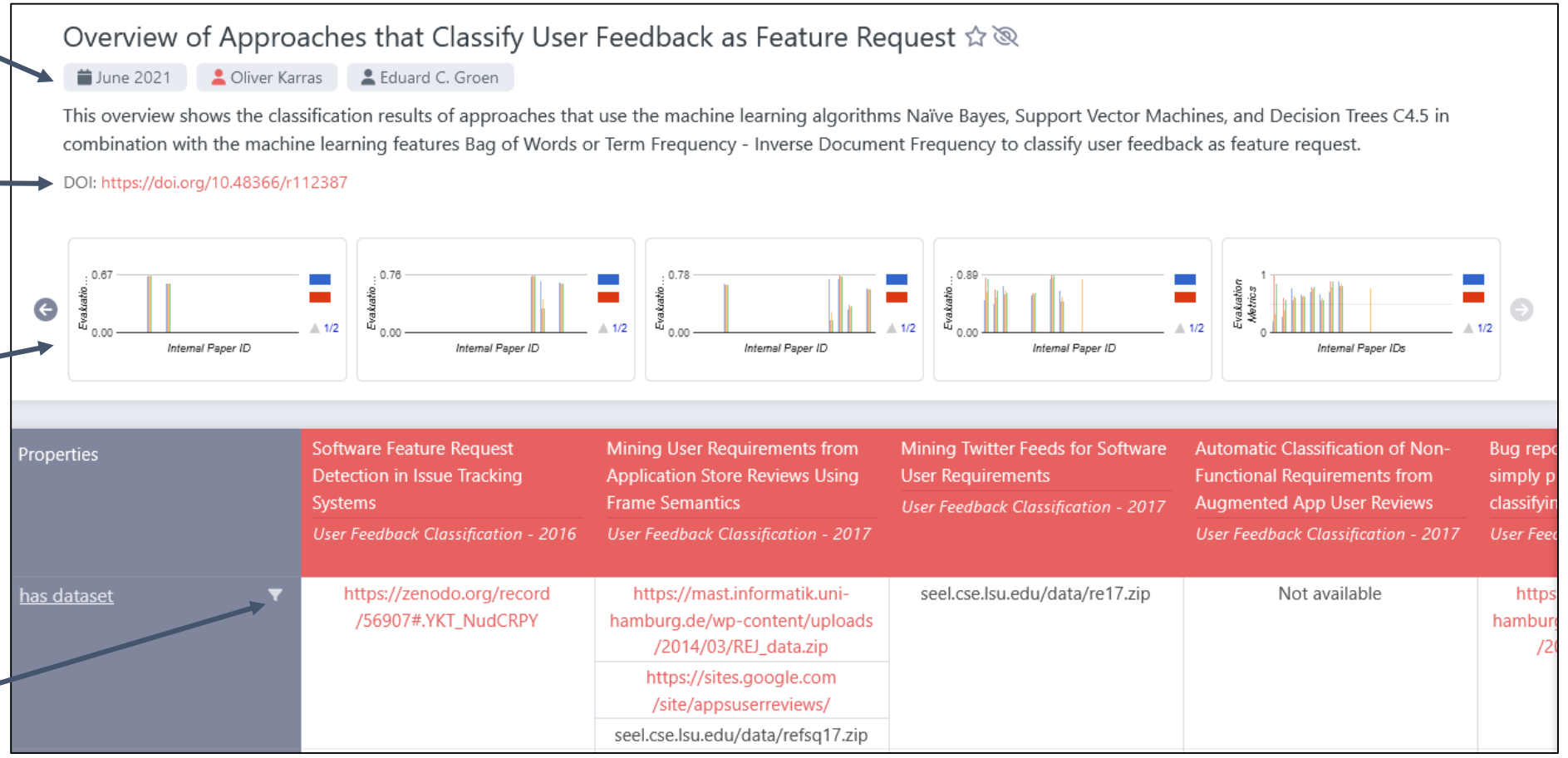
ORKG Comparisons

Acknowledgement of creators

DOI

Visualizations

Interactive filtering



Example: ORKG Comparison of Related Work – State of the Art[5]

A Comparison of Scientific Publications on the State of Empirical Research in Requirements Engineering and Software Engineering

November 2023 | Oliver Karras | Felix Wernlein | Jil Ann-Christin Klünder | Sören Auer

Empirical Software Engineering

This comparison provides an overview of scientific publications that have investigated primary studies in requirements engineering and software engineering to give a snapshot of the "current" state of empirical research in requirements engineering and software engineering. In particular, the comparison shows for each publication (1) which research fields and topics were investigated, (2) whether and where the extracted and analyzed data is available, and (3) which method was used to determine the state, including further details about the respective method.

DOI: https://doi.org/10.48366/R650023

Properties	Empirical research in requirements engineering: trends and opportunities *Empirical research - 2016*	Empirical research methodologies and studies in Requirements Engineering: How far did we come? *Empirical research - 2014*	A Survey on Empirical Requirements Engineering Research Practices *Empirical research - 2012*	Evidence-Based Structuring and Evaluation of Empirical Research in Requirements Engineering: Fundamentals, Framework, Research Map *Empirical research - 2010*	An Analy... Requirer... Data *Empirica...*
research problem	empirical research in requirements engineering	empirical research in requirements engineering	empirical research in requirements engineering	empirical research in requirements engineering	empirica...
research field investigated	Requirements Engineering	Requirements Engineering	Requirements Engineering	Requirements Engineering	Requ...
topic investigated	bibliographic metadata context data collection	bibliographic metadata research topic theory	context	context	

https://doi.org/10.48366/R650023

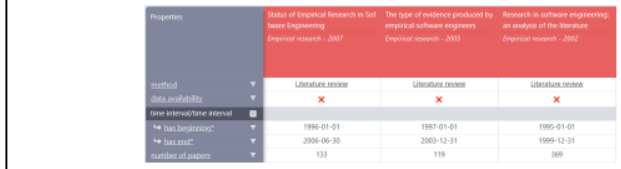


Figure 1: *Comparison* of related publications on the "current" state and evolution of empirical research in RE and SE [16].

Figure 1 shows an excerpt from a comparison that we created to get an overview of related publications on the "current" state and evolution of empirical research in RE and SE [16]. For three publications, the excerpt shows the method used, the data availability, as well as the period and the number of papers examined. We use the ORKG due to its cross-domain and cross-topic characteristics, as well as its successful application for CrowdRE by Karras et al. [42].

III. Related Work

Below, we review 14 publications that provide snapshots of the "current" state and evolution of empirical research in RE and SE (see Table I) [16]. We only consider publications that address the topic in general and are not limited to specific aspects, such as a method [67], [68] or a context [69], [70].

We found five publications on empirical research in RE published between 2005 and 2016 and nine on empirical research in SE published between 2002 and 2021. While one publication [1] examined empirical research in RE using a survey with 42 respondents, the other 13 publications [2], [3], [5]–[15] used (systematic) literature reviews or systematic mapping studies to analyze on average 402.9 papers (minimum: 20, median: 154, and maximum: 2237 papers) published between 1977 and 2019 with overlapping periods. In total, these 13 publications examined papers from a total of 60 different venues on 18 different themes. Nine of the 60 venues and ten of the 18 themes were examined by more than two publications. These facts show that there is considerable overlap and redundancy between these publications in terms of goals, methods used, periods, venues, and themes examined. This overlap and redundancy could have been avoided if researchers had collaborated to build on and update earlier works. However, only four out of 14 publications offer their data at all, with only one publication [15] using a public data repository [71], [72]. The other three publications only offer links that no longer work [5], [12], [13].

In terms of key findings, the 14 publications show consistent results, although not all 18 themes were examined in all publications. For example, eleven of the 14 publications reported on the most commonly used research methods. Until 2000, the most common research methods were conceptual analysis and concept implementation [7]. Between 2000 and 2015, the most commonly used research methods changed to case studies and experiments [3], [5], [8]–[11], which were expanded after 2015 to also include surveys and systematic literature reviews [12]–[15]. While this change shows an evolution of research methods used, we also note that experiments and case studies have been the two main research methods for empirical research in RE and SE for more than 20 years. Although these two research methods have been used for a long time, seven publications concluded that there is a need to develop, expand, and use standardized terminology and theories (from other disciplines) to more consistently represent the empirical research conducted and better explain the results found [1], [2], [6]–[8], [12], [13]. In this regard, seven publications also analyzed the information reported for a comprehensive description of a research design. This information includes details about the research question(s) [1], contextual factors [6],

Table I: Details of related publications on the "current" state and evolution of empirical research in RE and SE [16].
Legend: Literature Review (LR), Systematic Literature Review (SLR), and Systematic Mapping Study (SMS)

Paper	Year	Field	Method	Period	Data basis	Dataset	Venues (Frequency > 2)	Themes (Frequency > 2)
[6]	2005	RE	LR	1986 – 2002	35 papers	Unavailable	1) Empirical Software Engineering Journal (8) 2) IEEE Software (4) 3) Requirements Engineering Journal (4) 4) ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (4) 5) IEEE Transactions on Software Engineering (3) 6) Information and Software Technology Journal (3) 7) IEEE International Requirements Engineering Conference (3) 8) Journal of Systems and Software (3) 9) International Conference on Software Engineering (3)	1) Data collection (12) 2) Research method (11) 3) Bibliographic metadata (10) 4) Data analysis (8) 5) Research paradigm (7) 6) Research design (7) 7) Research topic (5) 8) Research context (4) 9) Sample of population (4) 10) Theory (3)
[7]	2010		SLR	Unknown	154 papers	Broken link		
[1]	2012		Survey	10.03.2012 – 30.03.2012	42 respondents	Unavailable		
[2]	2014		LR	1983 – 2013	2237 papers	Unavailable		
[3]	2016		SMS	Open – 2012	270 papers	Unavailable		
[7]	2002		LR	1995 – 1999	369 papers	Unavailable		
[8]	2002		LR	1996 – 2002	68 papers	Unavailable		
[9]	2005		LR	1997 – 2005	119 papers	Unavailable		
[10]	2006		LR	1977 – 2005	63 papers	Unavailable		
[11]	2007	SE	LR	1996 – 2005	133 papers	Unavailable		
[12]	2015		SMS	1996 – 2013	891 papers	Broken link		
[13]	2018		SMS	2013 – 2017	538 papers	Broken link		
[14]	2019		SMS	1993 – 2014	541 papers	Unavailable		
[15]	2021		SMS	Open – 2019	20 papers	Available		

[5] Karras et al.: *Divide and Conquer the EmpiRE: A Community-Maintainable Knowledge Graph of Empirical Research in Requirements Engineering.* 2023 ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM), DOI: 10.1109/ESEM56168.2023.10304795, 2023.

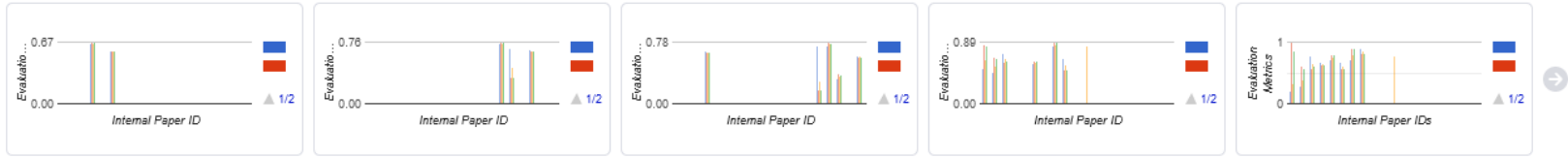
Example: ORKG Comparison of Literature – ML Approaches[9]

Overview of Approaches that Classify User Feedback as Feature Request

June 2021 | Oliver Karras | Eduard C. Groen

This overview shows the classification results of approaches that use the machine learning algorithms Naïve Bayes, Support Vector Machines, and Decision Trees C4.5 in combination with the machine learning features Bag of Words or Term Frequency - Inverse Document Frequency to classify user feedback as feature request.

DOI: https://doi.org/10.48366/r112387



Properties	Software Feature Request Detection in Issue Tracking Systems *User Feedback Classification - 2016*	Mining User Requirements from Application Store Reviews Using Frame Semantics *User Feedback Classification - 2017*	Mining Twitter Feeds for Software User Requirements *User Feedback Classification - 2017*	Automatic Classification of Non-Functional Requirements from Augmented App User Reviews *User Feedback Classification - 2017*	Bug repo simply p classifyin *User Feed*
has dataset	https://zenodo.org/record/56907#.YKT_NudCRPY	https://mast.informatik.uni-hamburg.de/wp-content/uploads/2014/03/REJ_data.zip https://sites.google.com/site/appsuserreviews/ seel.cse.lsu.edu/data/refsq17.zip	seel.cse.lsu.edu/data/re17.zip	Not available	https hamburg /2

https://doi.org/10.48366/r112387

Visualizations

Fig. 2: Excerpt from our comparison for Case II [35].

77 papers from the SLR by Khan et al. [18], describing the relation of the papers to five phases of RE and the CrowdRE utilities applied [36]. We are still in the process of adding the contributions from the remaining 50 papers, which is more time-consuming than for the quantitative data from Case I because of the expert judgments needed for classifying the papers' contributions. The comparison of the 27 papers makes it easy to identify, for example, the four papers that address the runtime purpose of monitoring for requirements evolution.

With the created comparisons [35], [36], we achieved our goal of acquiring and curating the detailed results of both SLRs. The knowledge-based representation in the form of comparisons has several advantages over a purely document-based representation. The comparisons are interactive and allow filtering of views by different scholarly knowledge contained in each row, even by specific value ranges of qualitative and quantitative content. The ORKG also provides a service for generating several graphical visualizations based on data in the comparisons, helping the reader understand information faster than through the large comparison table. The most important feature of the ORKG is that the added contributions and created comparisons are available to anyone. In this way, every crowd member can use the curated scholarly knowledge and created comparisons as a basis for new comparisons. Moreover, the existing comparisons can be expanded with additional scholarly knowledge from papers already included, and even with new contributions from papers added later to the ORKG. We already expanded several contributions, e.g., the results of other classifications reported in Dhinakaran et al.'s paper [40][10]. For Case I, we added the details of the three crowd properties *scale*, *level of knowledge*, *skills & expertise*; and *roles*, which are only briefly and superficially described in the SLR [18]. For Case II, we added links to the datasets used and performance values to classification categories other than "Feature Request". This expansion is relevant to enable long-term curation. For example, a development succeeding the SLR by Santos et al. [17] are reports of Deep Learning algorithms showing promising results in classifying user feedback [41], [42], which should be successively added to the comparison.

Despite all these advantages, the ORKG also has limitations. Most of the limitations we experienced can be attributed to the development status of the platform, which is currently in beta. Further development of the ORKG must improve interactions for the expert crowd by enabling better workflows for entering data and creating visualizations. Nevertheless, we also experienced that the project team has always responded directly to our reported issues, which we could see getting added to the GitLab issue tracker[11] and addressed shortly thereafter.

V. Discussion

The ORKG aroused our interest as a crowdsourcing platform for applying and communicating CrowdRE research. In this experience report, we explored whether the ORKG can promote the potential of CrowdRE in open source and open research settings, taking two perspectives: that of CrowdRE researchers and that of crowd members.

Our first contribution is that we provide a comprehensive overview of the ORKG's features as a crowdsourcing platform for acquiring and curating scholarly knowledge [37], mapped to the four key activities of CrowdRE. Our findings show that the ORKG is a crowdsourcing platform offering several features that can facilitate successful CrowdRE. Although the ORKG project team has not yet consciously applied CrowdRE, they already address crucial parts of the CrowdRE cycle by motivating crowd members to participate, eliciting feedback, and monitoring context & usage data, which they analyze to derive and implement the needs and requirements of the crowd.

To motivate crowd members, the project team uses established mechanisms and incentives to boost intrinsic and extrinsic motivation (see Finding 1). Feedback is elicited

[10] https://www.orkg.org/orkg/paper/R76818/R76825

[11] https://gitlab.com/TIBHannover/orkg/orkg-frontend/-/issues/634

[9] Karras et al.: *Researcher or Crowd Member? Why not both! The Open Research Knowledge Graph for Applying and Communicating CrowdRE Research.* 2021 IEEE 29th International Requirements Engineering Conference Workshops (REW), DOI: 10.1109/REW53955.2021.00056, 2021.

Example: ORKG Comparison of Literature – Simulation Parameters[10]

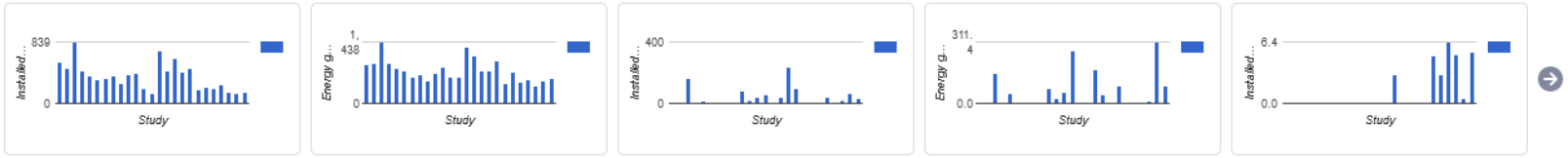
Comparison of Studies on Germany's Energy Supply in 2050

November 2021 | Felix Kullmann | Jan Göpfert | Oliver Karras | Patrick Kuckertz | Sören Auer | Markus Stocker | Peter Markewitz | Leander Kotzur | Detlef Stolten

NFDI4Ing Energy System Research

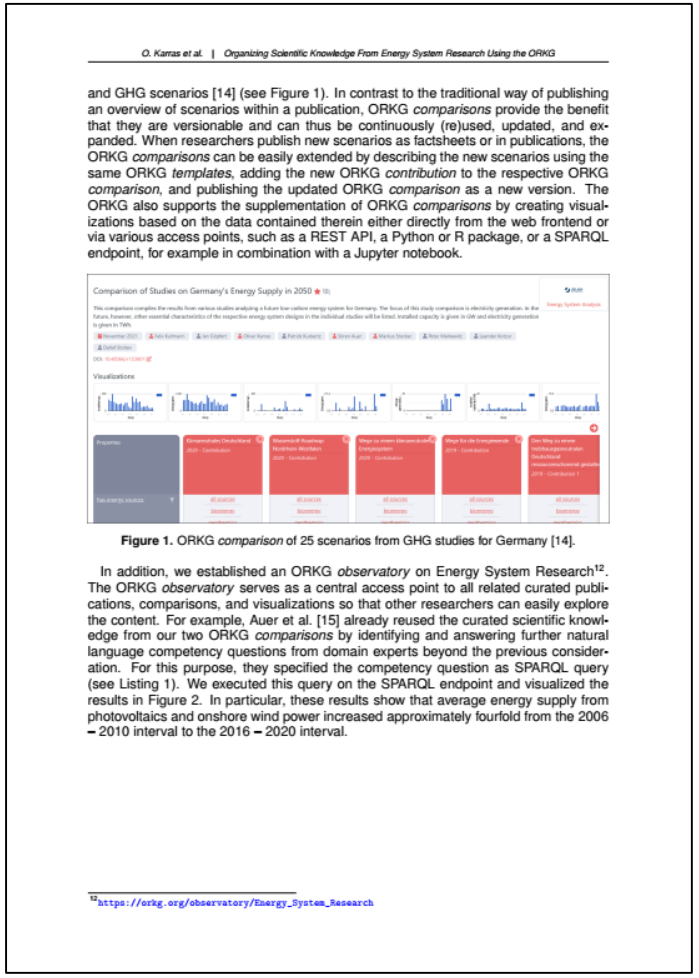
This comparison compiles the results from various studies analyzing a future low-carbon energy system for Germany. The focus of this study comparison is electricity generation. In the future, however, other essential characteristics of the respective energy system designs in the individual studies will be listed. Installed capacity is given in GW and electricity generation is given in TWh. The authors would like to thank the German Federal Government, the German State Governments, and the Joint Science Conference (GWK) for their funding and support as part of the NFDI4Ing consortium. Funded by the German Research Foundation (DFG) - project number: 442146713. This work was also supported by the Helmholtz Association under the program "Energy System Design".

DOI: https://doi.org/10.48366/r153801



Properties	Klimaneutrales Deutschland *Contribution - 2020*	Wasserstoff-Roadmap Nordrhein-Westfalen *Contribution - 2020*	Wege zu einem klimaneutralen Energiesystem *Contribution - 2020*	Wege für die Energiewende *Contribution - 2019*	Den We... treibhau... Deutsch... gestalte... *Contribu...*
has energy sources	all sources	all sources	all sources	all sources	
	bioenergy	bioenergy	bioenergy	bioenergy	
	geothermics	geothermics	geothermics	geothermics	
	hydropower	hydropower	hydropower	hydropower	
	import	import			
	net import	net import			

https://doi.org/10.48366/r153801



O. Karras et al. | Organizing Scientific Knowledge From Energy System Research Using the ORKG

and GHG scenarios [14] (see Figure 1). In contrast to the traditional way of publishing an overview of scenarios within a publication, ORKG *comparisons* provide the benefit that they are versionable and can thus be continuously (re)used, updated, and expanded. When researchers publish new scenarios as factsheets or in publications, the ORKG *comparisons* can be easily extended by describing the new scenarios using the same ORKG *templates*, adding the new ORKG *contribution* to the respective ORKG *comparison*, and publishing the updated ORKG *comparison* as a new version. The ORKG also supports the supplementation of ORKG *comparisons* by creating visualizations based on the data contained therein either directly from the web frontend or via various access points, such as a REST API, a Python or R package, or a SPARQL endpoint, for example in combination with a Jupyter notebook.

Figure 1. ORKG *comparison* of 25 scenarios from GHG studies for Germany [14].

In addition, we established an ORKG *observatory* on Energy System Research[12]. The ORKG *observatory* serves as a central access point to all related curated publications, comparisons, and visualizations so that other researchers can easily explore the content. For example, Auer et al. [15] already reused the curated scientific knowledge from our two ORKG *comparisons* by identifying and answering further natural language competency questions from domain experts beyond the previous consideration. For this purpose, they specified the competency question as SPARQL query (see Listing 1). We executed this query on the SPARQL endpoint and visualized the results in Figure 2. In particular, these results show that average energy supply from photovoltaics and onshore wind power increased approximately fourfold from the 2006 – 2010 interval to the 2016 – 2020 interval.

[12] https://orkg.org/observatory/Energy_System_Research

[10] Karras et al.: *Organizing Scientific Knowledge From Energy System Research Using the Open Research Knowledge Graph.* 1st NFDI4Energy Conference, DOI: 10.48550/arXiv.2401.13365, 2024.

Example: ORKG Comparison of Literature – Process Variants[11]

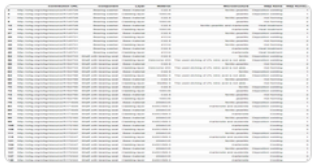
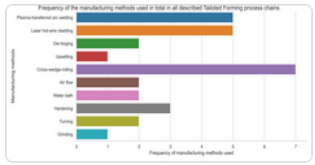
Tailored Forming Process Chain for the Manufacturing of Hybrid Components with Bearing Raceways Using Different Material Combinations ★

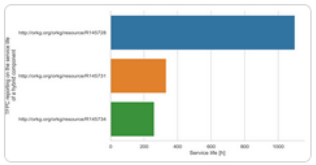
May 2022 | Oliver Karras | Laura Budde | Paulina Merkel

This comparison provides an overview of Tailored Forming process chains carried out in the CRC 1153 "Tailored Forming" for the manufacturing of hybrid components with bearing raceways using different material combinations. A variety of materials combinations is used for the Tailored Forming of such hybrid components. The comparison shows the combined materials, the entire Tailored Forming process chain with its individual steps, and the resulting hybrid component with its qualities. For each step, the comparison shows the measurement methods performed and their results for the individual qualities of the hybrid components. In this way, the comparison shows how different qualities of the hybrid components change during the process due to the manufacturing methods used.

DOI: https://doi.org/10.48366/r187049

Data analysis with Juypter notebook



Properties	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats *Air-cooled 2 Cladding Layer Component (x45CrSi9-3) - 2022*	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats *Air-cooled 3 Cladding Layer Component (x45CrSi9-3) - 2022*	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats *Water-cooled 2 Cladding Layer Component (x45CrSi9-3) - 2022*	Investigation of the material combination 20MnCr5 and X45CrSi9-3 in the Tailored Forming of shafts with bearing seats *Water-cooled 3 Cladding Layer Component (x45CrSi9-3) - 2022*	Cross-w welded rolling b material *1 Claddi (100Cr6)*
has material/material					
belongs to material group*	Steel	Steel	Steel	Steel	
has type*	20MnCr5 X45CrSi9-3	20MnCr5 X45CrSi9-3			

https://doi.org/10.48366/r187049

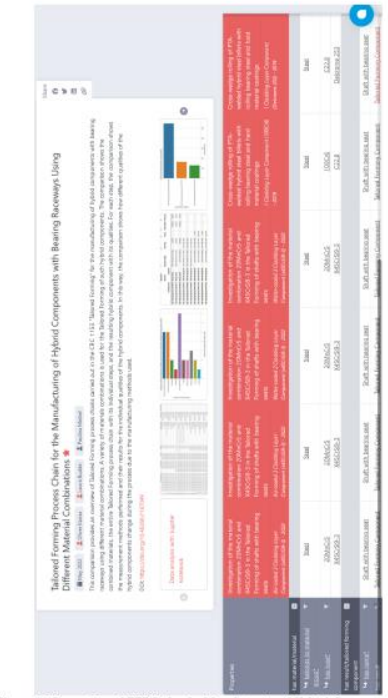


Figure 7: Comparison of TFPCs for the Manufacturing of Hybrid Components [38].

12

[11] Karras et al.: *Organizing Scientific Knowledge from Engineering Sciences Using the Open Research Knowledge Graph: The Tailored Forming Process Chain Use Case.* **Under Review** at Data Science Journal, 2024.

Example: ORKG Comparison of Literature – Software Features[12]

Comparison of Hyperparameter Optimization Tools

January 2023 | Oliver Karras | Difan Deng | Marius Lindauer

This comparison looks at the capabilities of various optimization tools for hyperparameter optimization, focusing on the following: Complex hyperparameter space, multi-objective, multi-fidelity, instances, command-line interface, and parallel computing. In addition, this comparison provides further information about the respective optimization tool, such as the locations of the code repository, README, software documentation and issue tracker, license and programming language.

DOI: https://doi.org/10.48366/r281265

Properties	BoTorch: A Framework for Efficient Monte-Carlo Bayesian Optimization *BoTorch - 2020*	OpenBox: A Generalized Black-box Optimization Service *OpenBox - 2021*	BOHB: Robust and Efficient Hyperparameter Optimization at Scale *HpBandSter - 2018*	SMAC3: A Versatile Bayesian Optimization Package for Hyperparameter Optimization *SMAC3 - 2021*
result/software				
name*	BoTorch	OpenBox	HpBandSter	SMAC3
software features*	Multi-Fidelity Multi-Objective parallel computing	Complex Hyperparameter Space Multi-Objective parallel computing	Complex Hyperparameter Space Multi-Fidelity parallel computing	command-line interface Complex Hyperparameter Space Instances Multi-Fidelity Multi-Objective parallel computing
complex hyperparameter space*	✗	✓	✓	✓
multi-objective*	✓	✓	✗	✓
multi-fidelity*	✓	✗		
instance*	✗	✗		

https://doi.org/10.48366/r281265

Command-Line Interface

SMAC can not only be executed within a python file but also from the commandline. Consequently, not only algorithms in python can be optimized, but implementations in other languages as well.

Note

Command-line interface has been temporarily disabled in v2.0. Please fall back to v1.4 if you need it.

Comparison

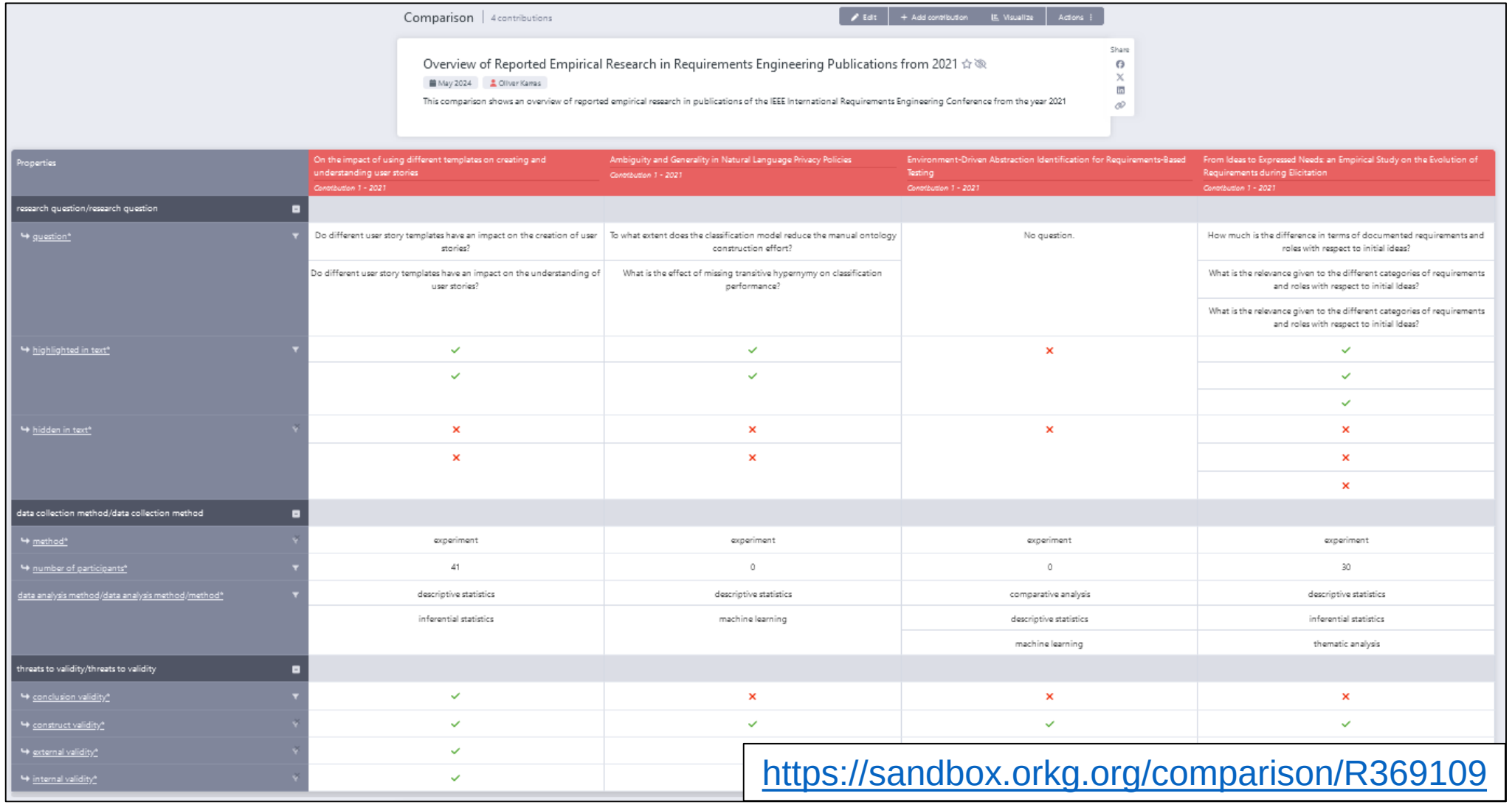
The following table provides an overview of SMAC's capabilities in comparison with other optimization tools.

Package	Complex Hyperparameter Space	Multi-Objective	Multi-Fidelity	Instances	Comma
HyperMapper	✓	✓	✗	✗	✗
Optuna	✓	✓	✓	✗	✓
Hyperopt	✓	✗	✗	✗	✓
BoTorch	✗	✓	✓	✗	✗
OpenBox	✓	✓	✗	✗	✗
HpBandSter	✓	✗	✓	✗	✗
SMAC	✓	✓	✓	✓	✓

Previous Installation | Next Getting Started

[9] Lindauer et al.: *SMAC3 Documentation*, URL: https://automl.github.io/SMAC3/v1.4.0/getting_started/package_overview.html#comparison, 2024.

Goal: ORKG Comparison on Reported Empirical Research



Comparison | 4 contributions

Edit | + Add contribution | Visualize | Actions

Overview of Reported Empirical Research in Requirements Engineering Publications from 2021

May 2024 | Oliver Karras

This comparison shows an overview of reported empirical research in publications of the IEEE International Requirements Engineering Conference from the year 2021

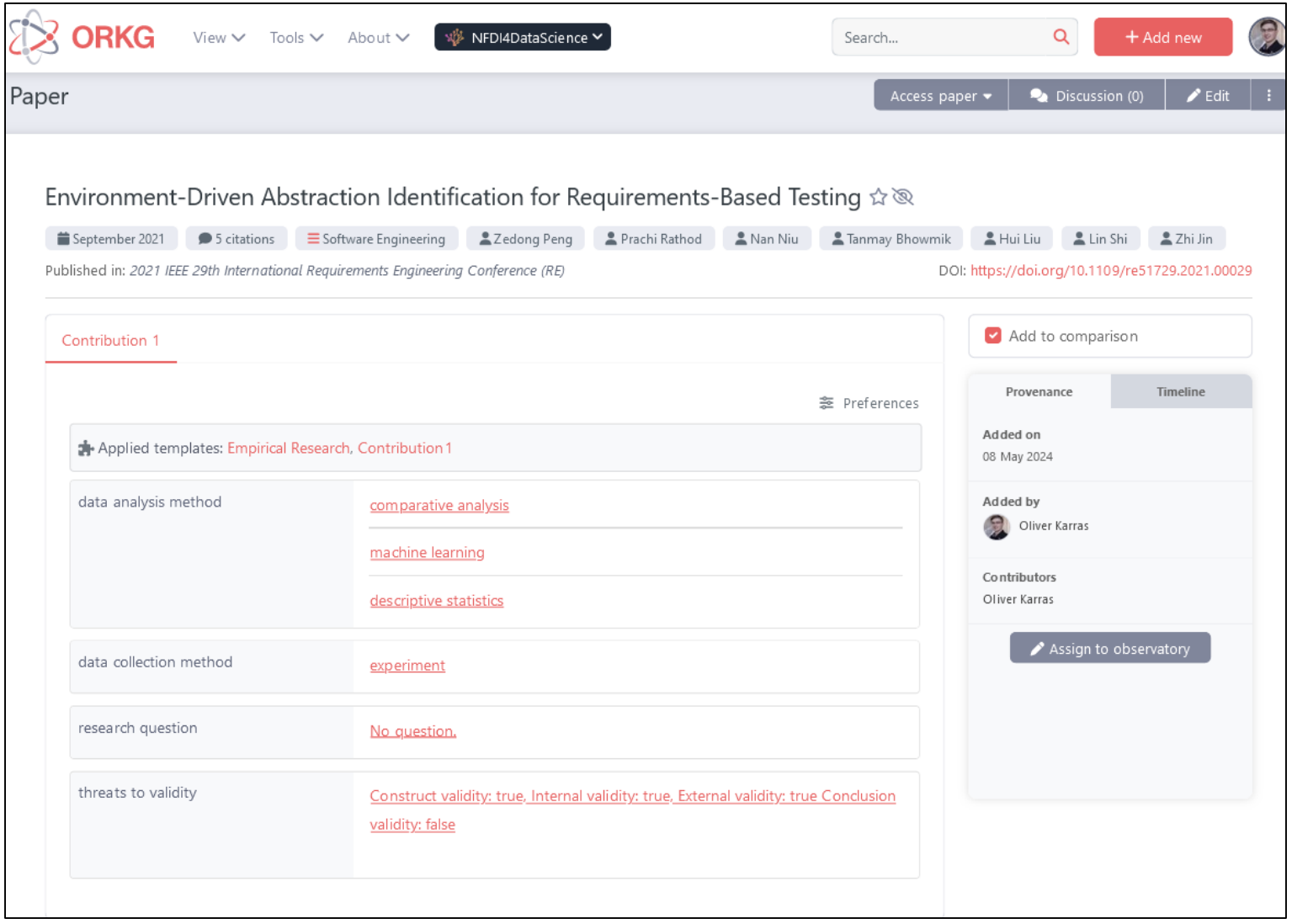
Share

Properties	On the impact of using different templates on creating and understanding user stories *Contribution 1 - 2021*	Ambiguity and Generality in Natural Language Privacy Policies *Contribution 1 - 2021*	Environment-Driven Abstraction Identification for Requirements-Based Testing *Contribution 1 - 2021*	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation *Contribution 1 - 2021*
research question/research question				
question*	Do different user story templates have an impact on the creation of user stories?	To what extent does the classification model reduce the manual ontology construction effort?	No question.	How much is the difference in terms of documented requirements and roles with respect to initial ideas?
	Do different user story templates have an impact on the understanding of user stories?	What is the effect of missing transitive hypernymy on classification performance?		What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
				What is the relevance given to the different categories of requirements and roles with respect to initial ideas?
highlighted in text*	✓	✓	✗	✓
	✓	✓		✓
				✓
hidden in text*	✗	✗	✗	✗
	✗	✗		✗
				✗
data collection method/data collection method				
method*	experiment	experiment	experiment	experiment
number of participants*	41	0	0	30
data analysis method/data analysis method/method*	descriptive statistics	descriptive statistics	comparative analysis	descriptive statistics
	inferential statistics	machine learning	descriptive statistics	inferential statistics
			machine learning	thematic analysis
threats to validity/threats to validity				
conclusion validity*	✓	✗	✗	✗
construct validity*	✓	✓	✓	✓
external validity*	✓			
internal validity*	✓			

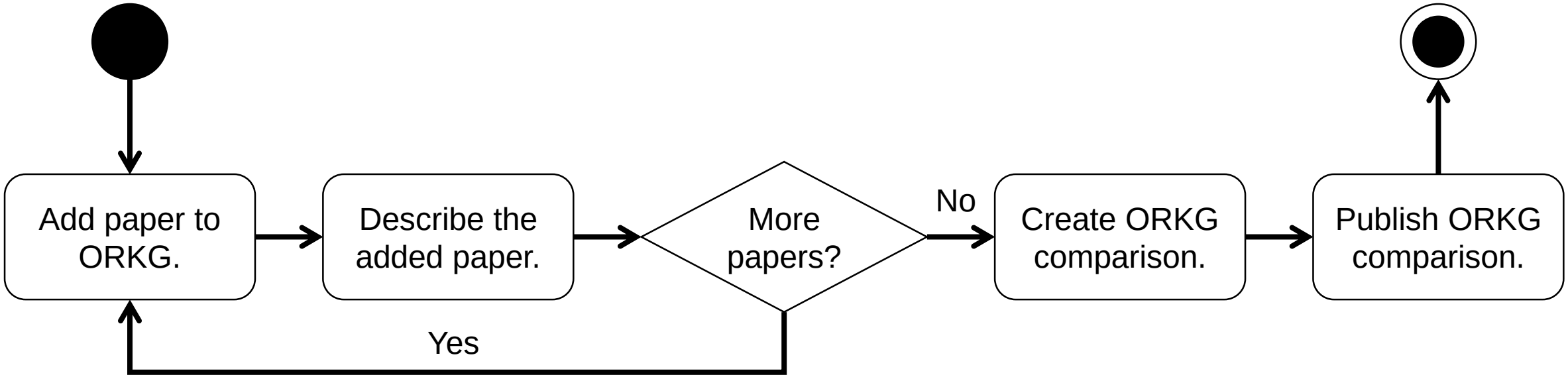
https://sandbox.orkg.org/comparison/R369109

Topic: Reported Empirical Research

- Empirical Research
  - *Research question*
    - Question
    - Hidden in text
    - Highlighted in text
  - *Data Collection Method*
    - Method
    - Number of participants
  - *Data Analysis Method*
    - Method
  - *Threats to Validity*
    - Construct Validity
    - Internal Validity
    - External Validity
    - Conclusion Validity



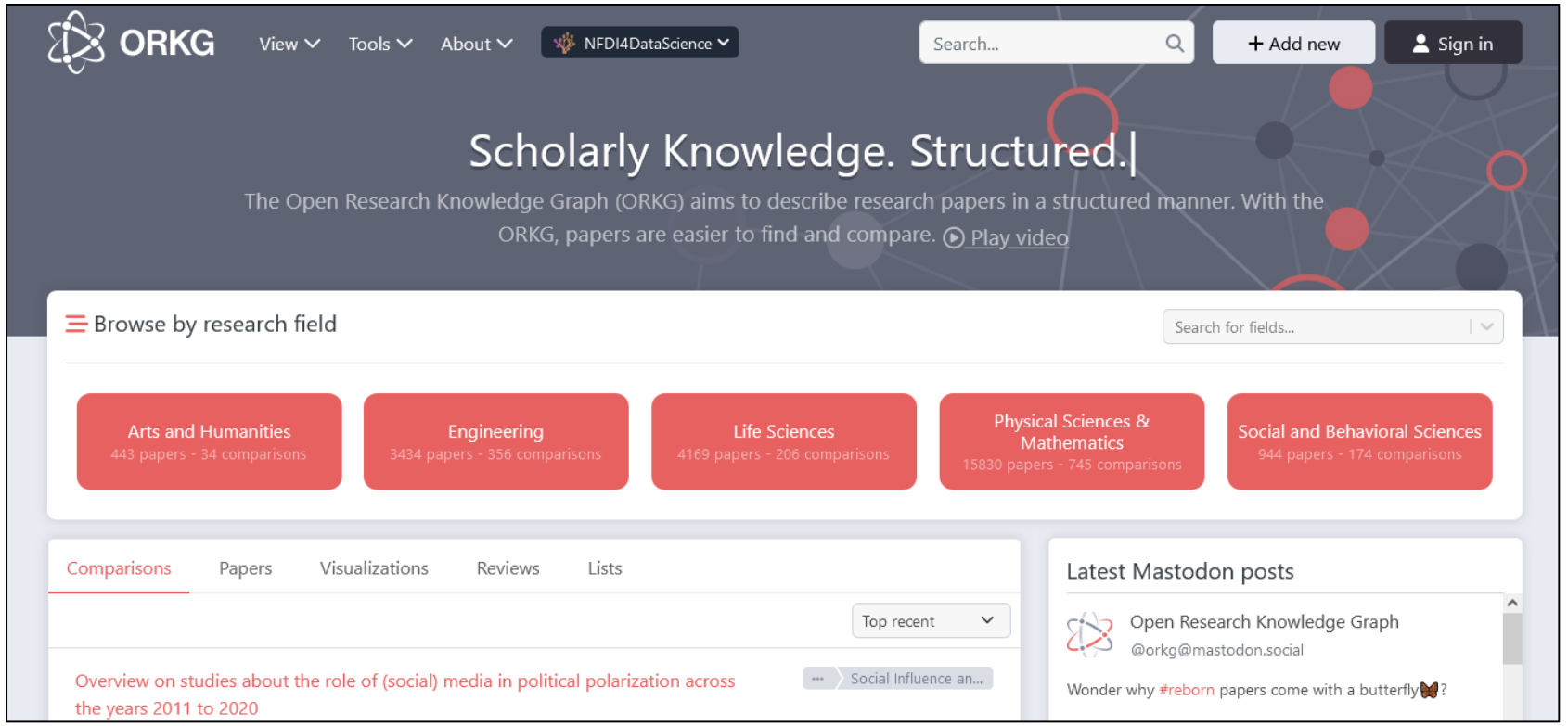
Overall Process for Creating an ORKG Comparison



Remark:
Instead of going through the loop, we will work **collaboratively** in the tutorial as conceived by ORKG. We will take all papers from all participants and compare them with each other in an ORKG comparison.

An ORKG comparison requires **at least two** publications.

1. Open ORKG Website



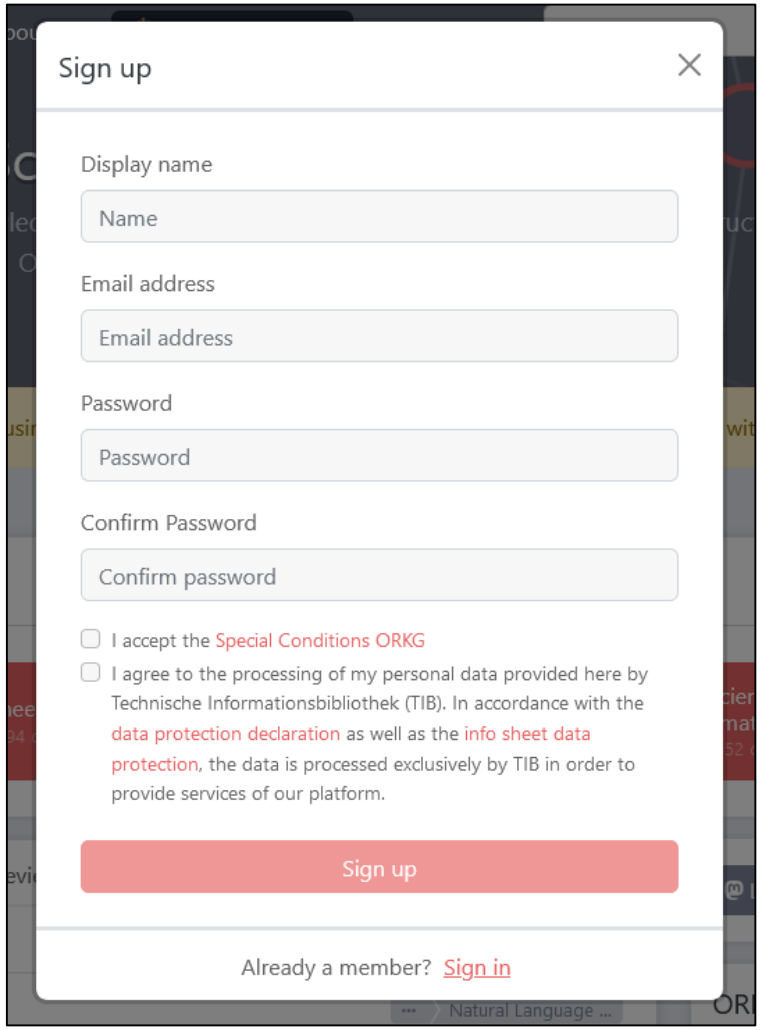
Remark:
For the tutorial, we use the **ORKG test environment** (https://sandbox.orkg.org/) to try everything without hesitation. You can find the official ORKG at https://orkg.org/.

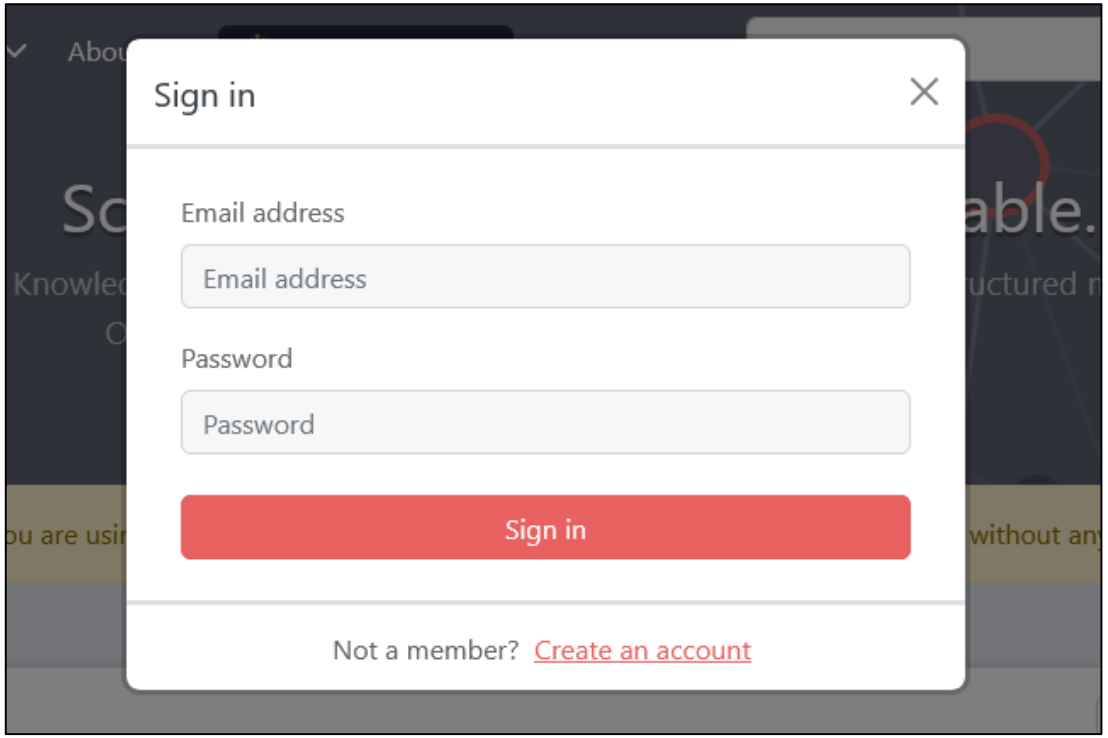
Get your exemplary paper: https://bit.ly/3UGFwhj

Use https://sandbox.orkg.org/!

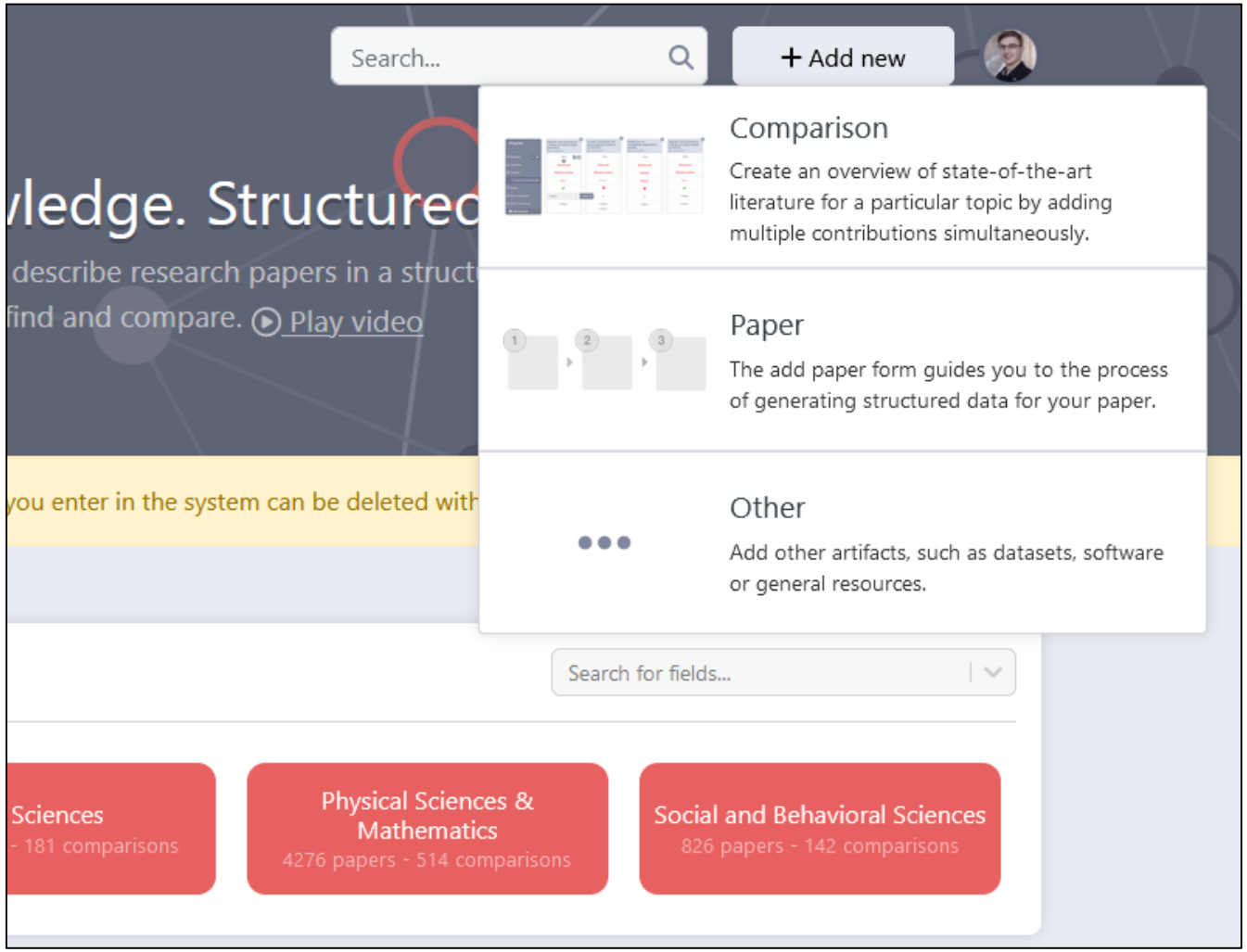
NOT https://orkg.org/!

2. Sign Up & Sign In





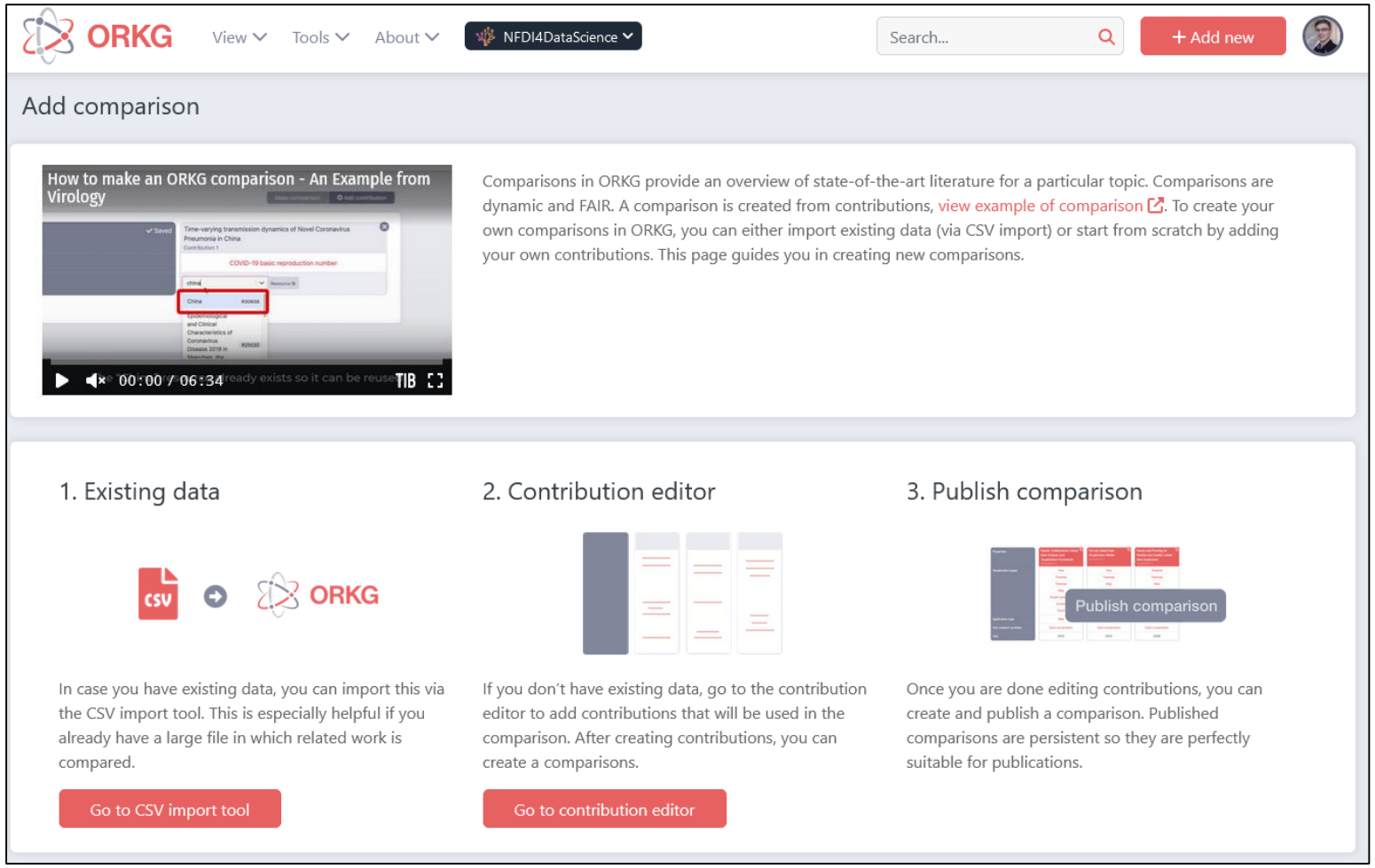
3. Add a New Comparison to the ORKG



1. Click on “+Add new”
2. Select “Comparison”

Remark:
We could also start by adding individual papers, but since we want to create a comparison at the end, it is easy to start immediately.

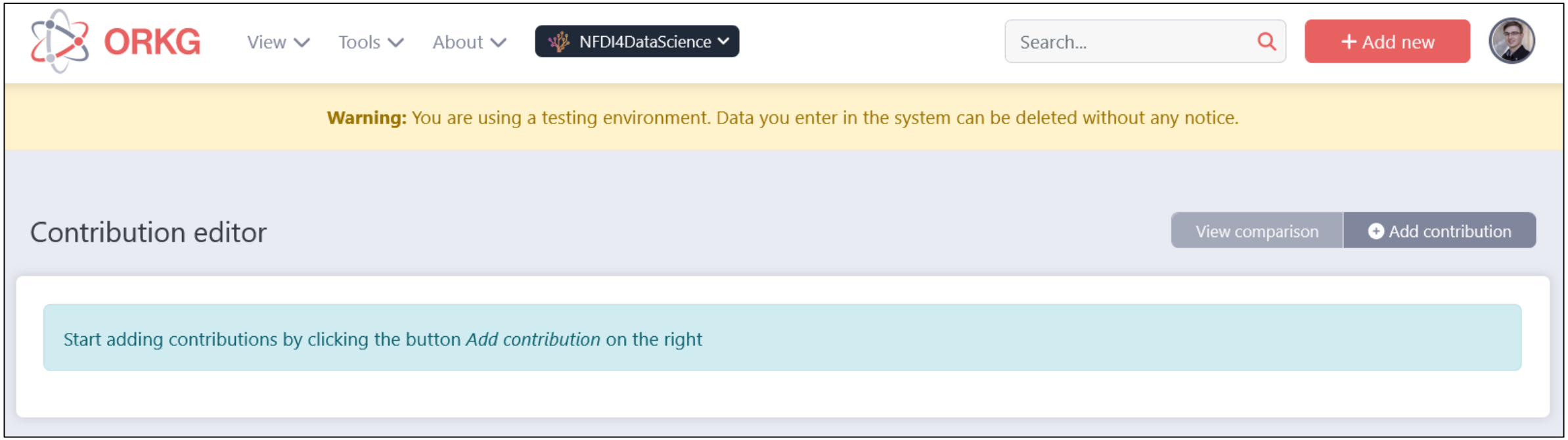
4. Go to the Contribution Editor

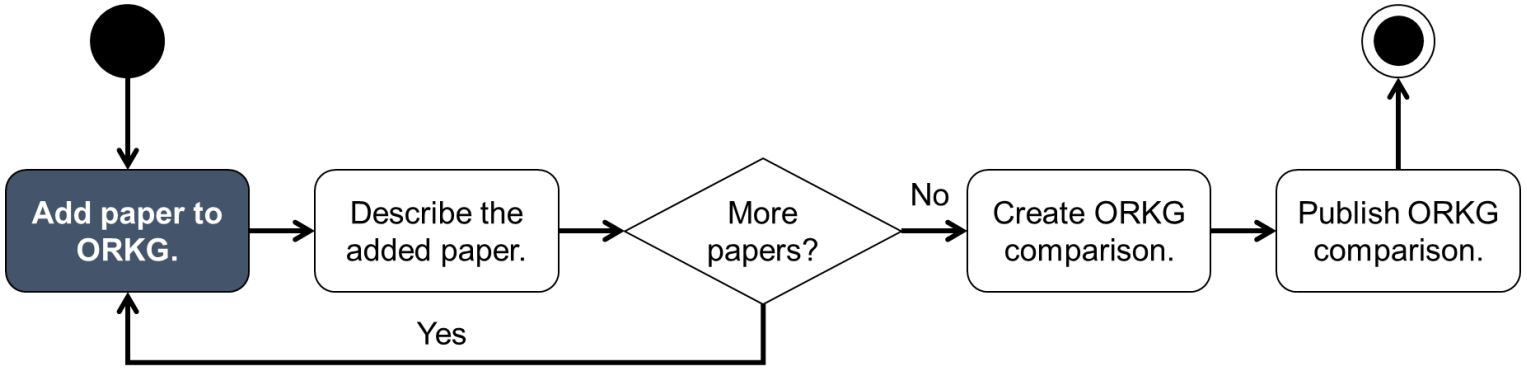


1. Click on “Go to contribution editor”

Remark:
When the data is already extracted, e.g., in a spreadsheet, we could use CSV import tool. However, the tool is a prototype and still requires a lot of manual work to map the data.

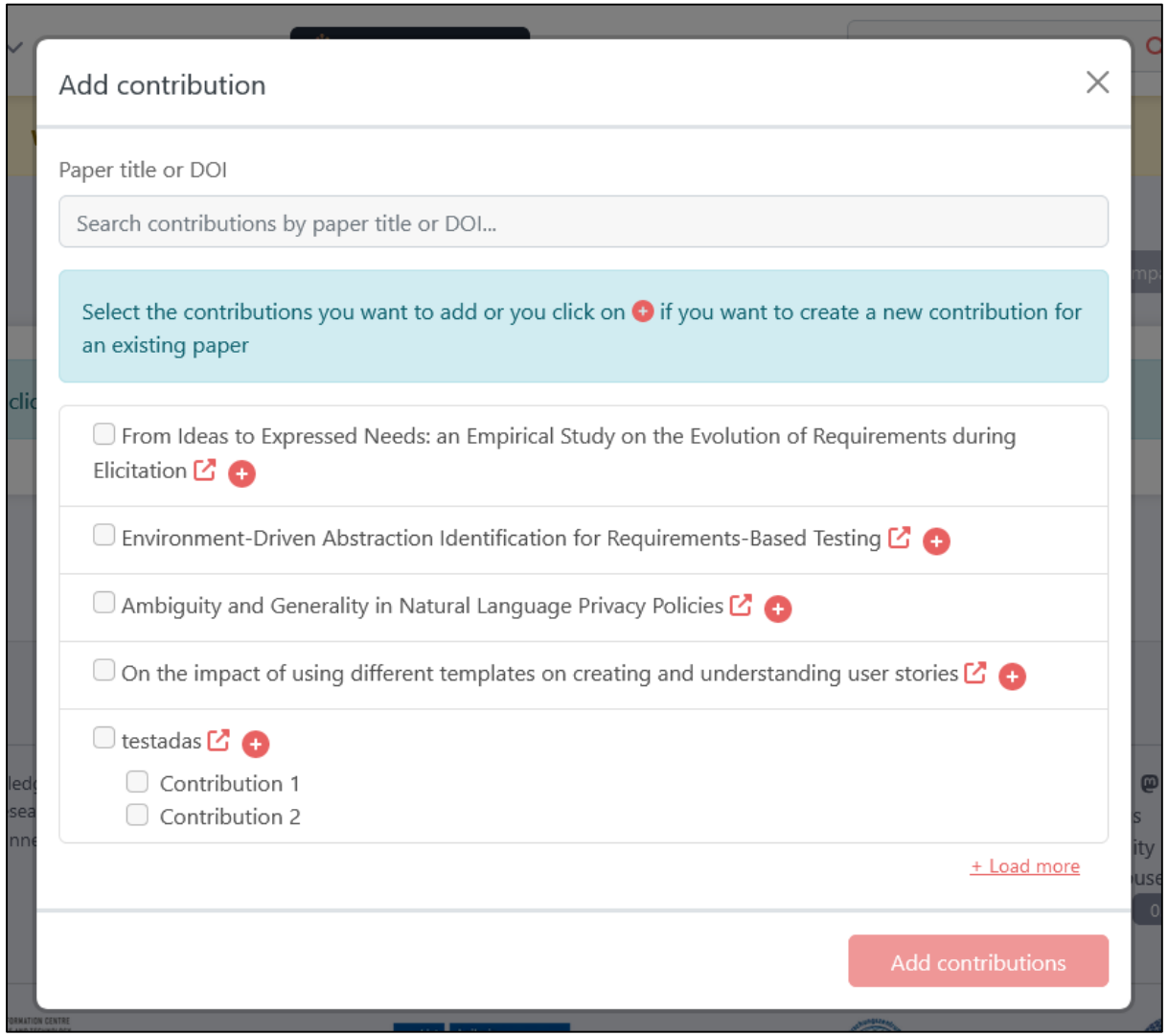
5. Add a Paper

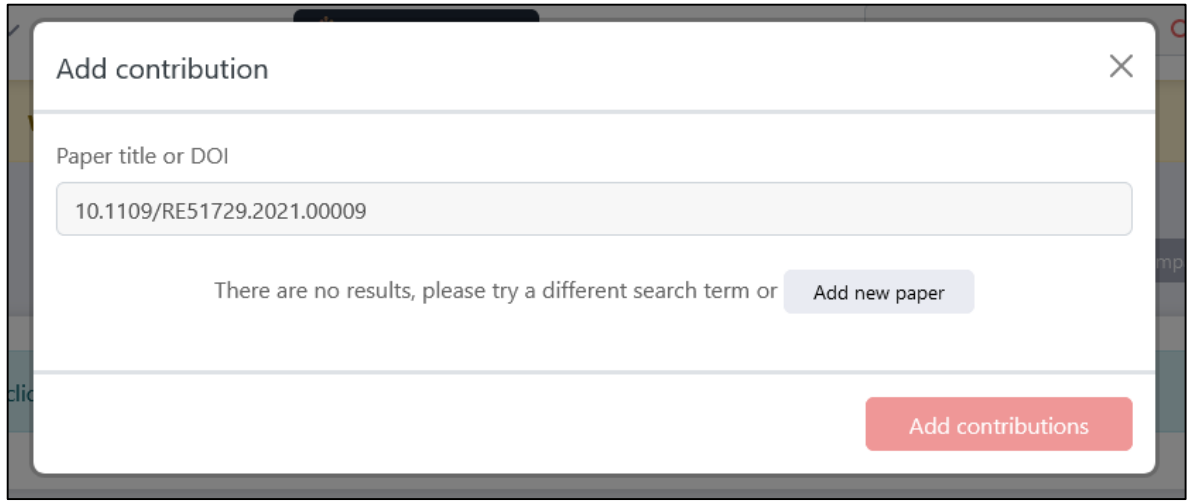




1. Click on “Add contribution”

5. Add a Paper: Enter DOI (or Paper Title)

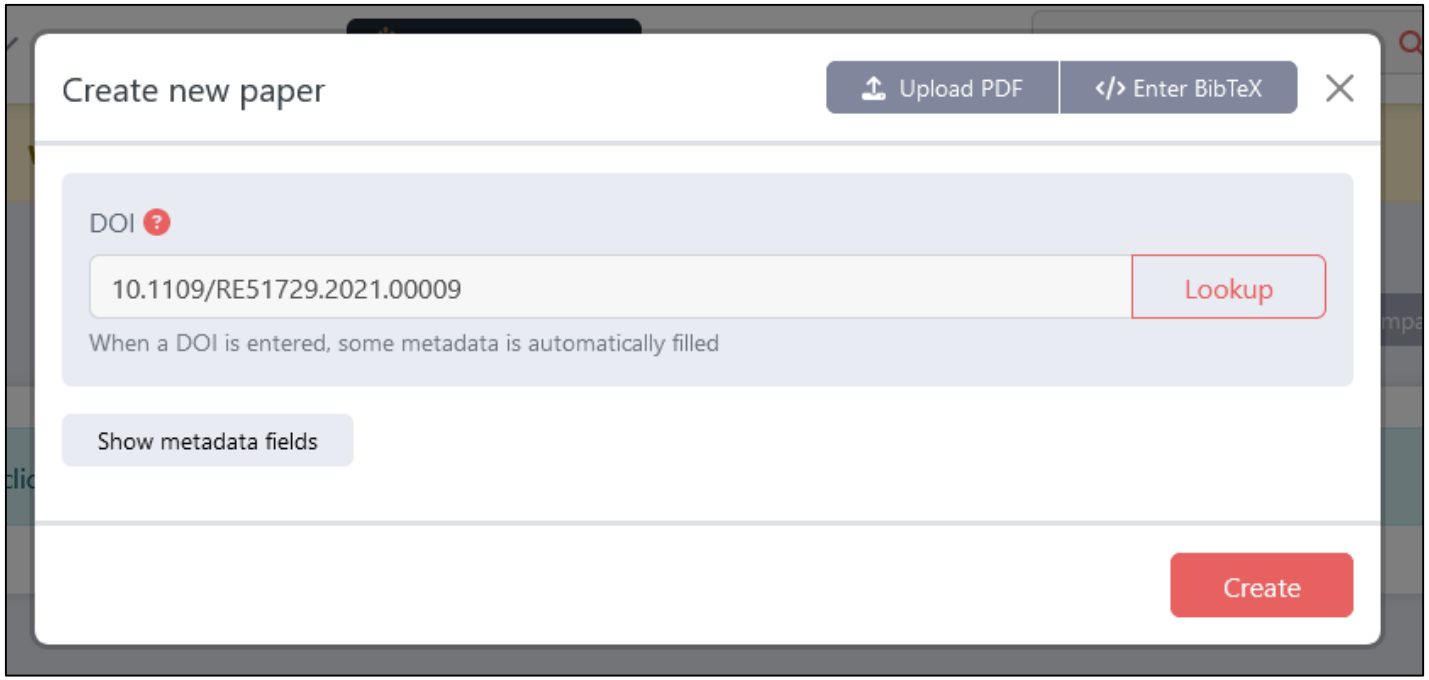




1. Click on “Add new paper”

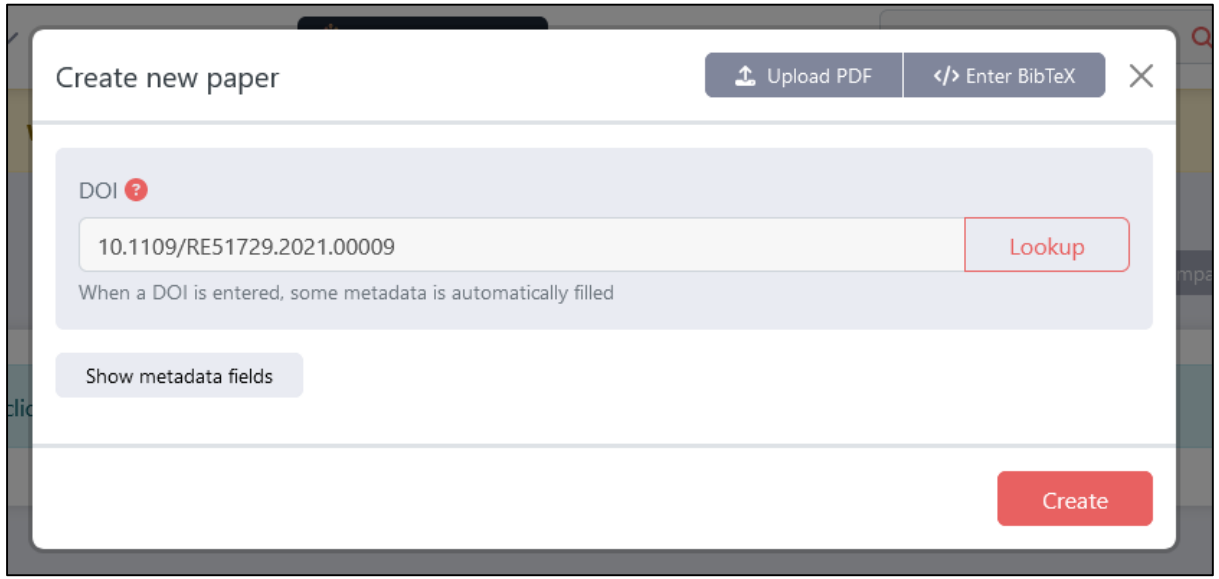
Remark:
If the paper is already in the ORKG, it is shown and we can either reuse an existing contribution or create a new one.

5. Add a Paper: Lookup Paper by DOI

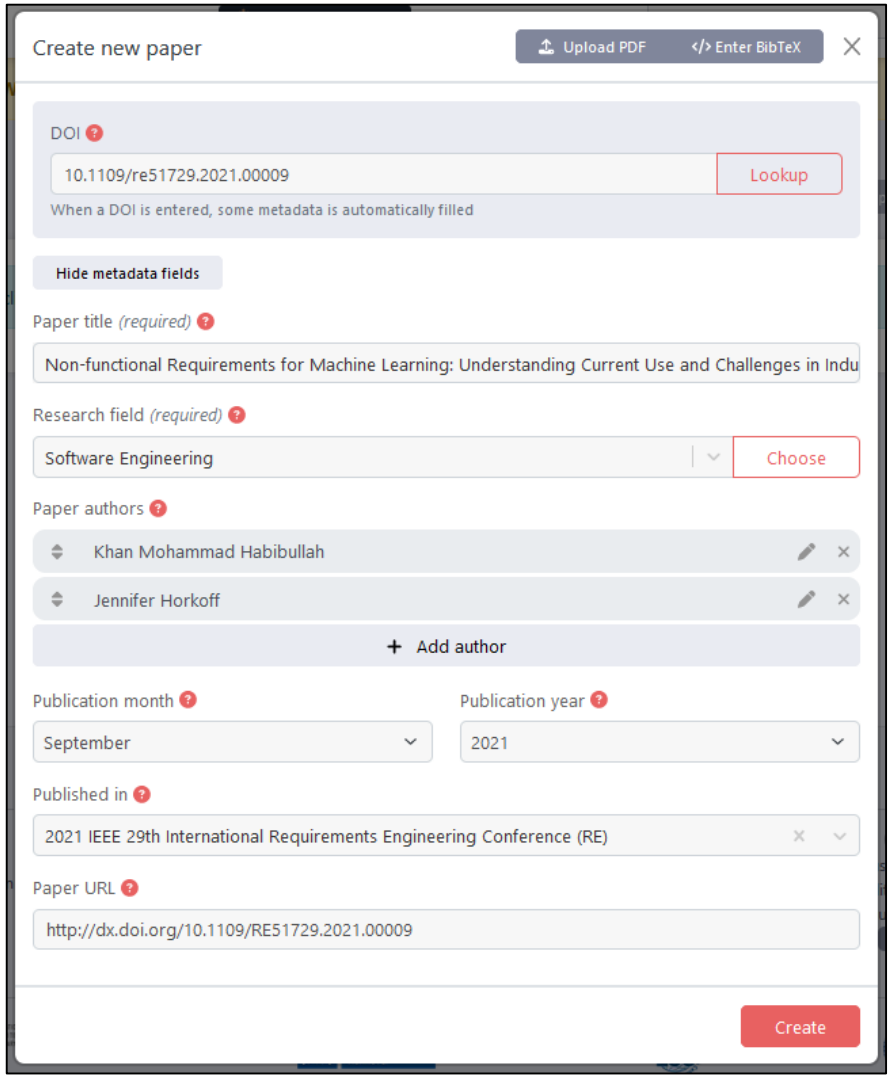


Remark:
ORKG attempts to retrieve the metadata automatically. If the retrieval is not successful, you can also manually enter or correct the metadata.

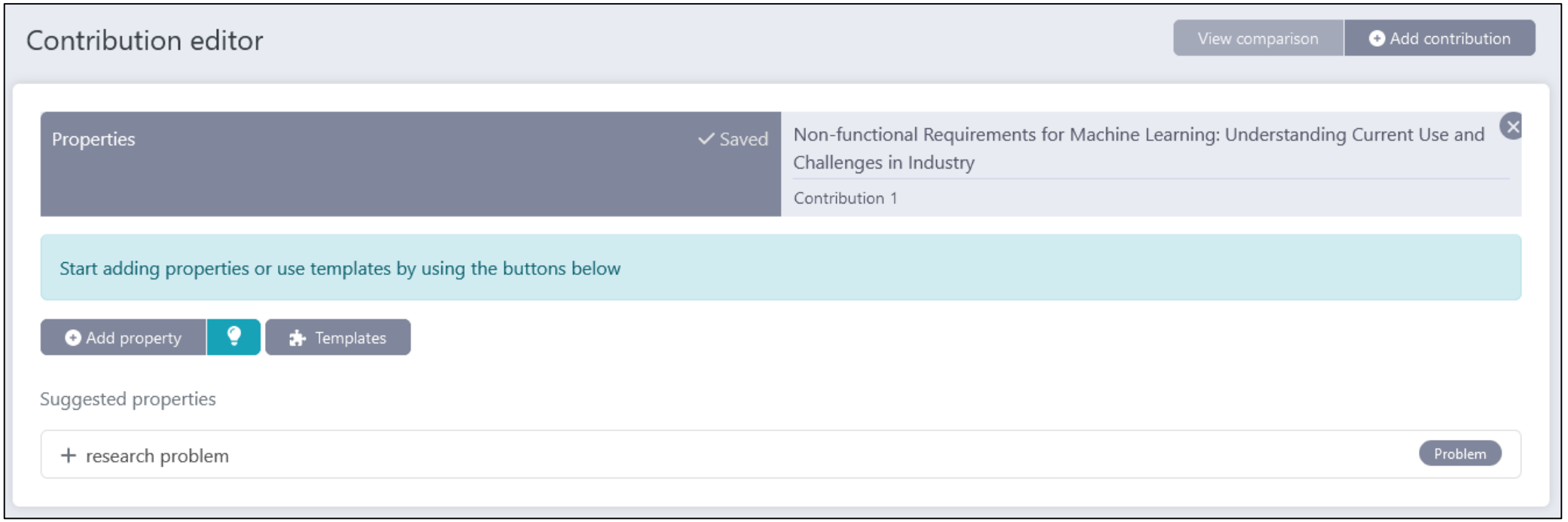
5. Add a Paper: Lookup Paper by DOI

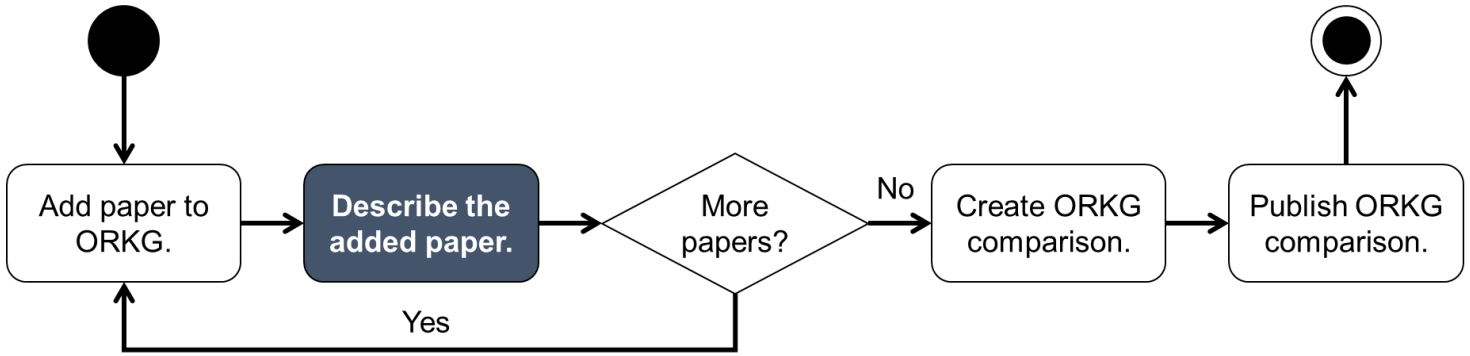


1. Click on “Lookup”
2. Check metadata fetched
3. Add a “Research field”. We use “Software Engineering”.
4. Click on “Create”



6. Describe a Paper



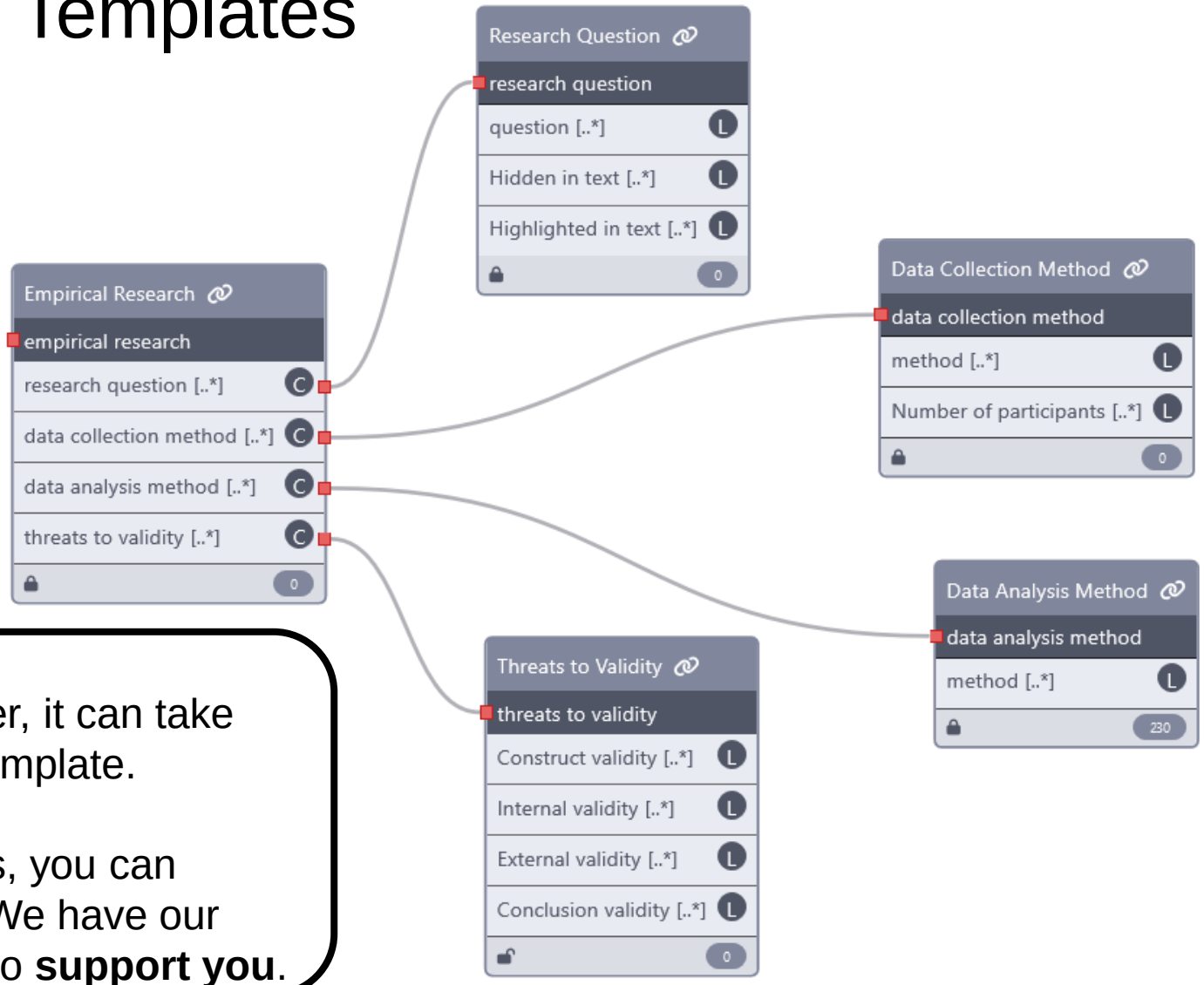


Remark:
Instead of adding all properties individually, we use an ORKG template.

6. Describe a Paper: ORKG Templates

An **ORKG template** specifies the **structure** and **terminology** used to describe a **publication** in the ORKG. Its use **ensures FAIR data** that is **consistent** and **comparable** across publications.

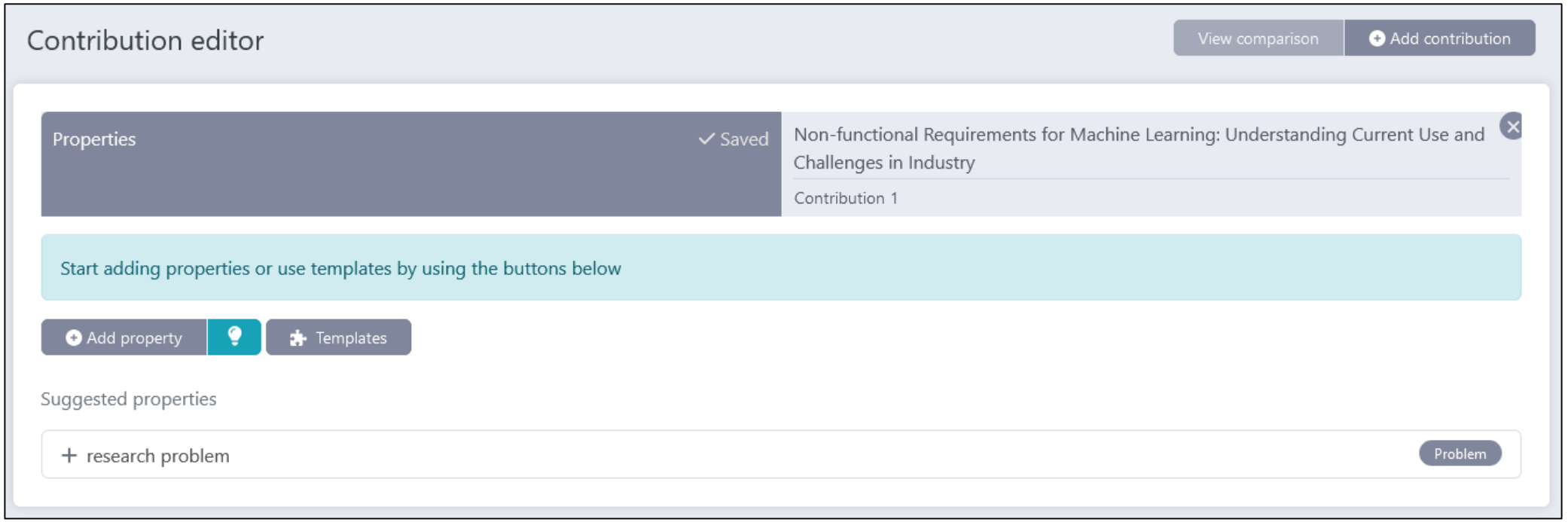
https://sandbox.orkg.org/template/R369028



Remark:
Every user can create ORKG templates. However, it can take some time and practice to build a good ORKG template.

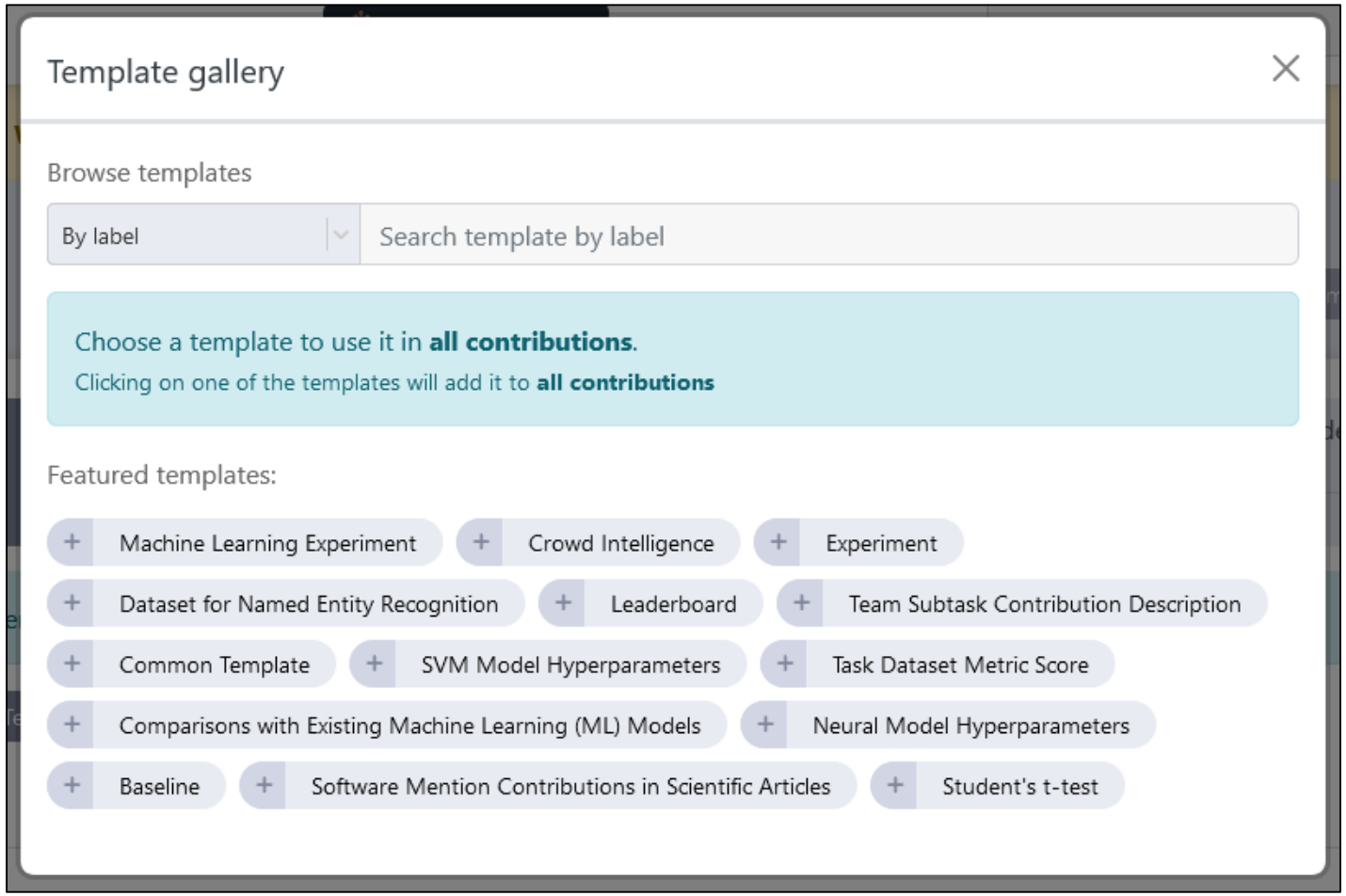
If you want to use the feature and have problems, you can always contact the ORKG team, especially me. We have our own **Curation and Community Building team** to **support you**.

6. Describe a Paper: Add Template “Empirical Research”



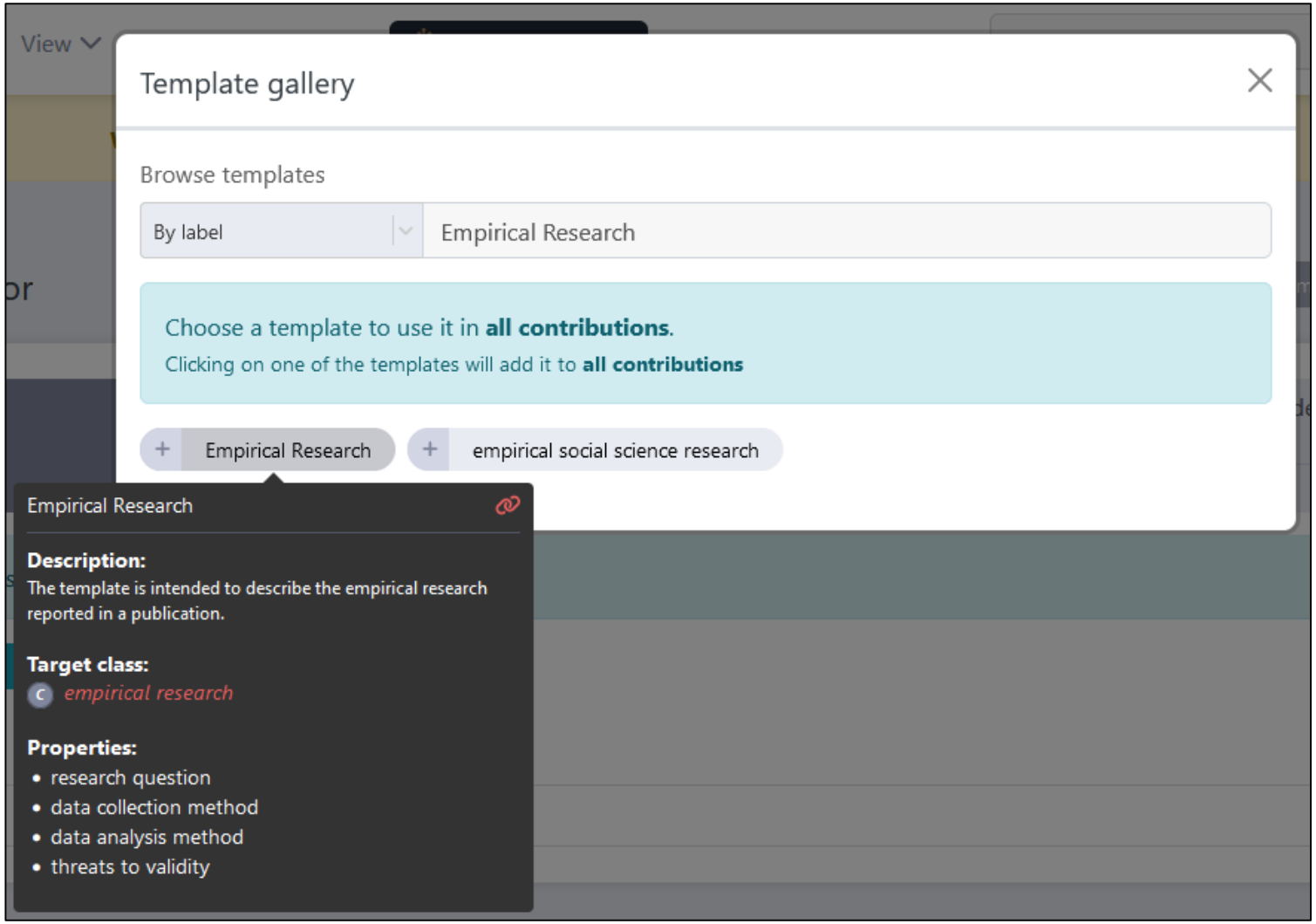
1. Click on “Templates”

6. Describe a Paper: Add Template “Empirical Research”



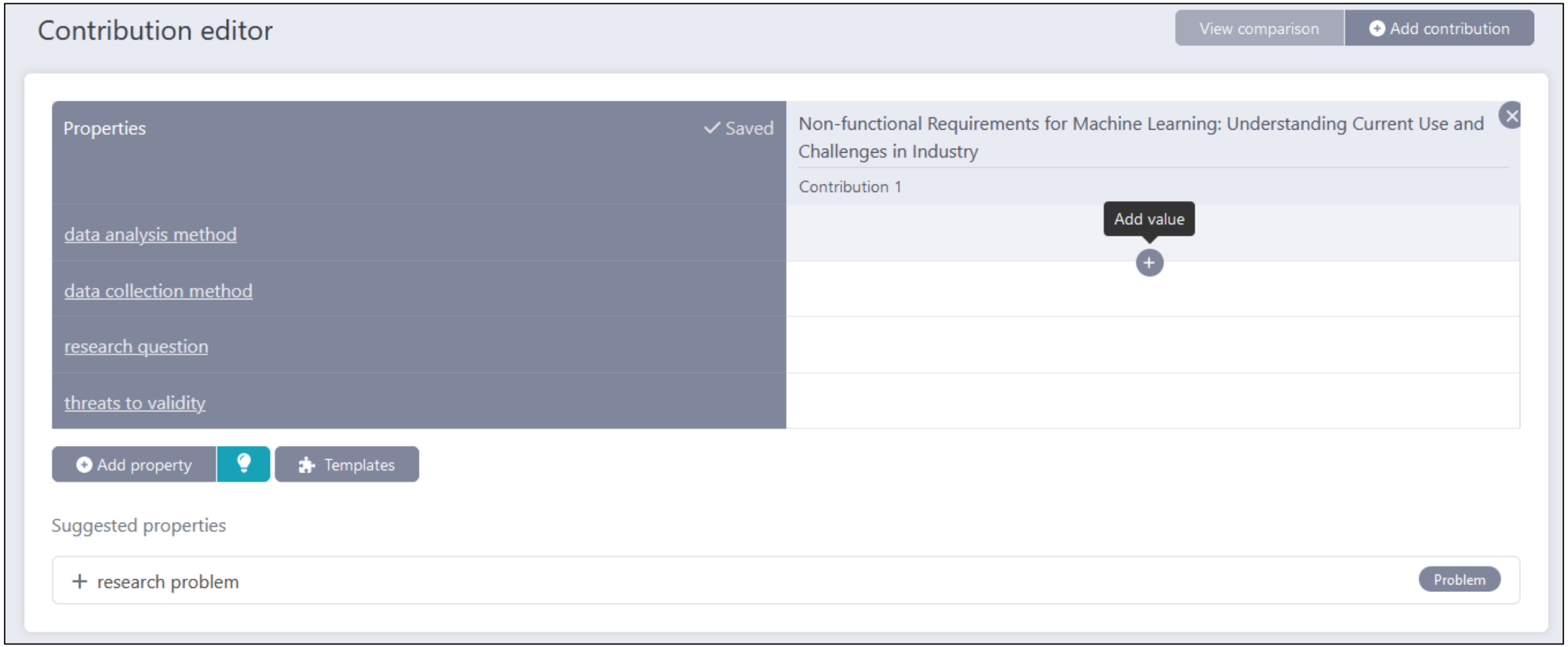
1. Search for “Empirical Research”

6. Describe a Paper: Add Template “Empirical Research”



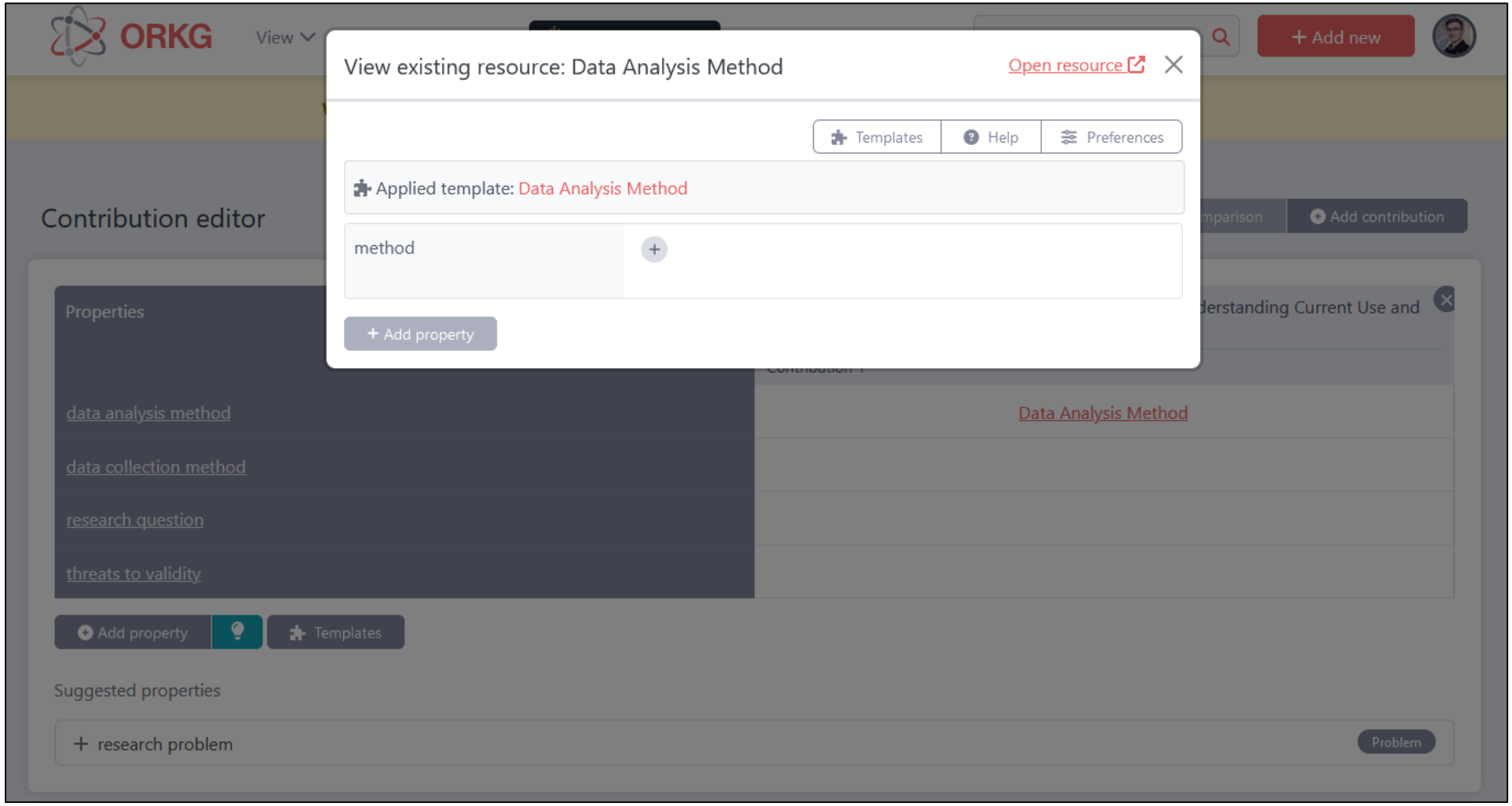
1. Select “Empirical Research”

6. Describe a Paper: Fill out the Table



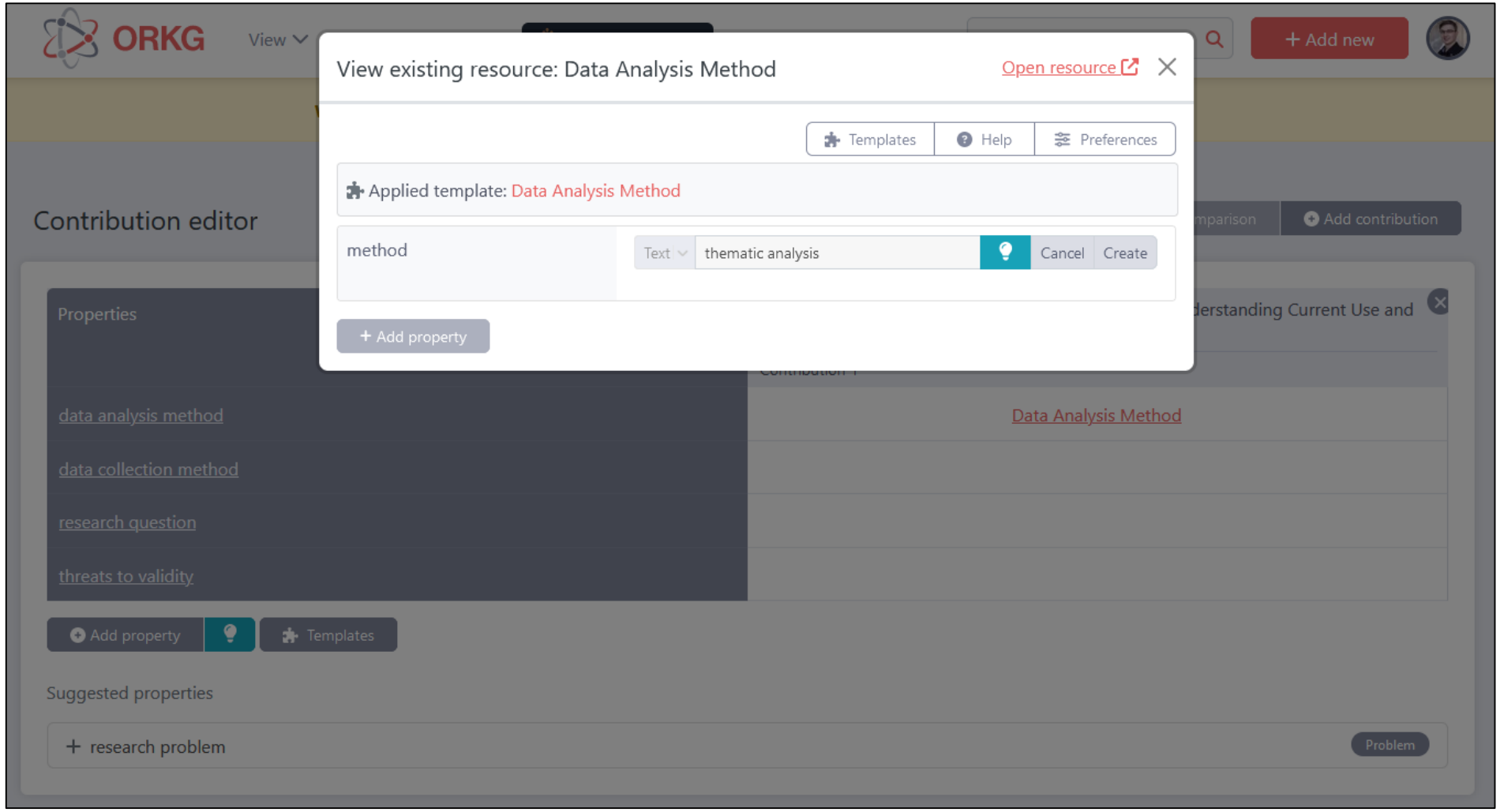
1. Click “Add value” for adding the data analysis method

6. Describe a Paper: Enter the Data Analysis Method(s)



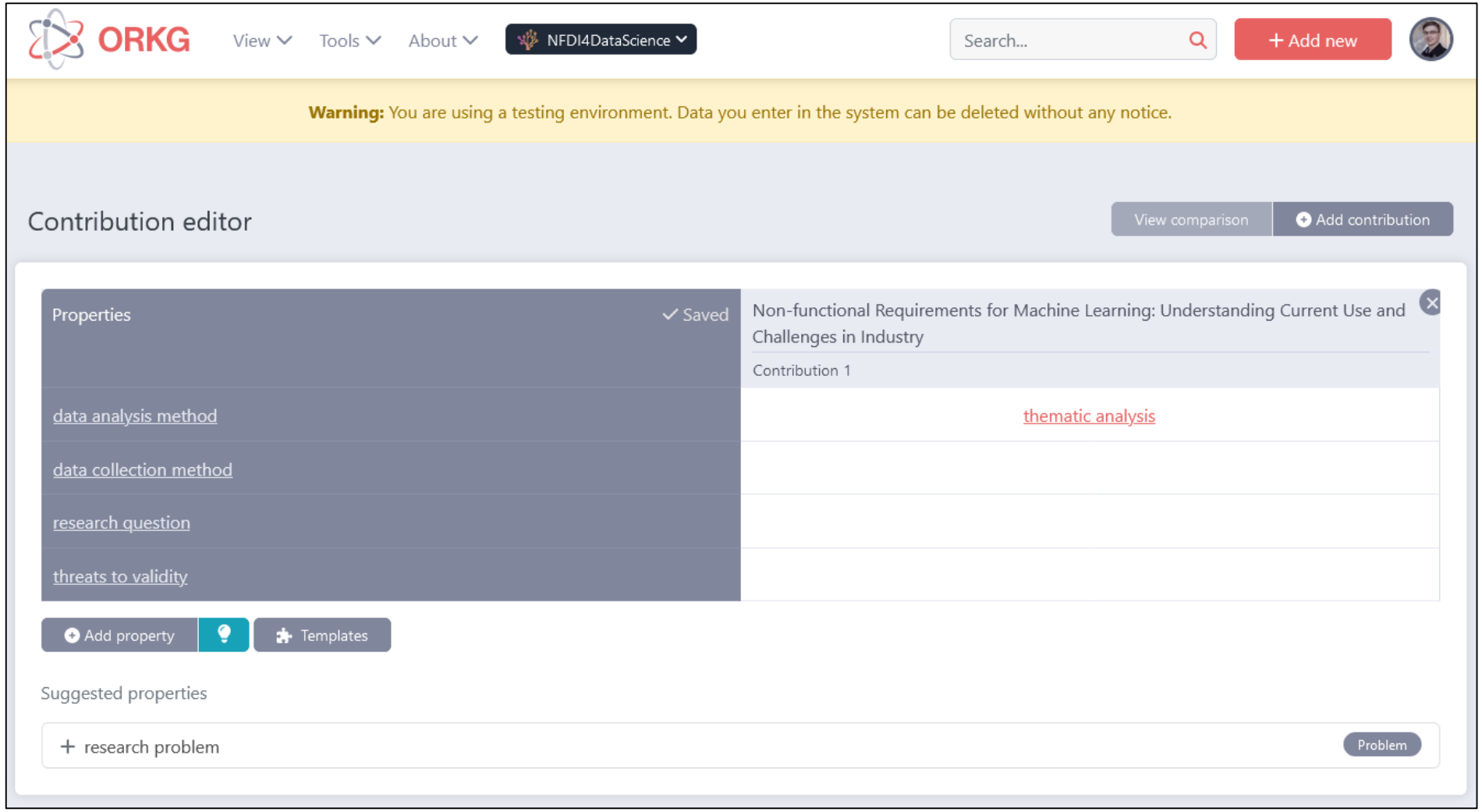
1. Click the ⊕
2. Enter method

6. Describe a Paper: Enter the Data Analysis Method(s)



1. Click “Create”
2. Close dialog

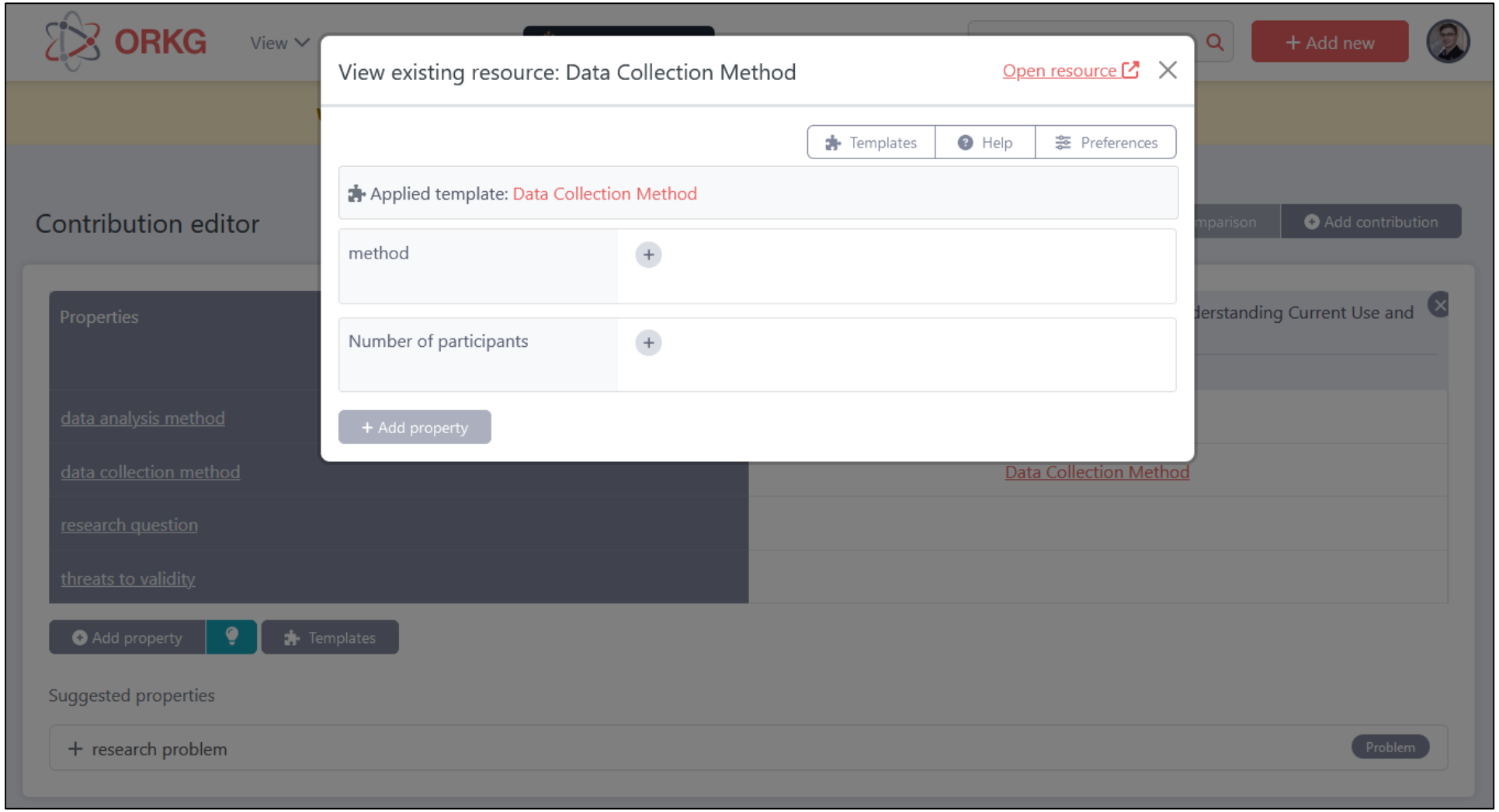
6. Describe a Paper: Enter the Data Analysis Method(s)



If you have more analysis methods, **repeat** the process.

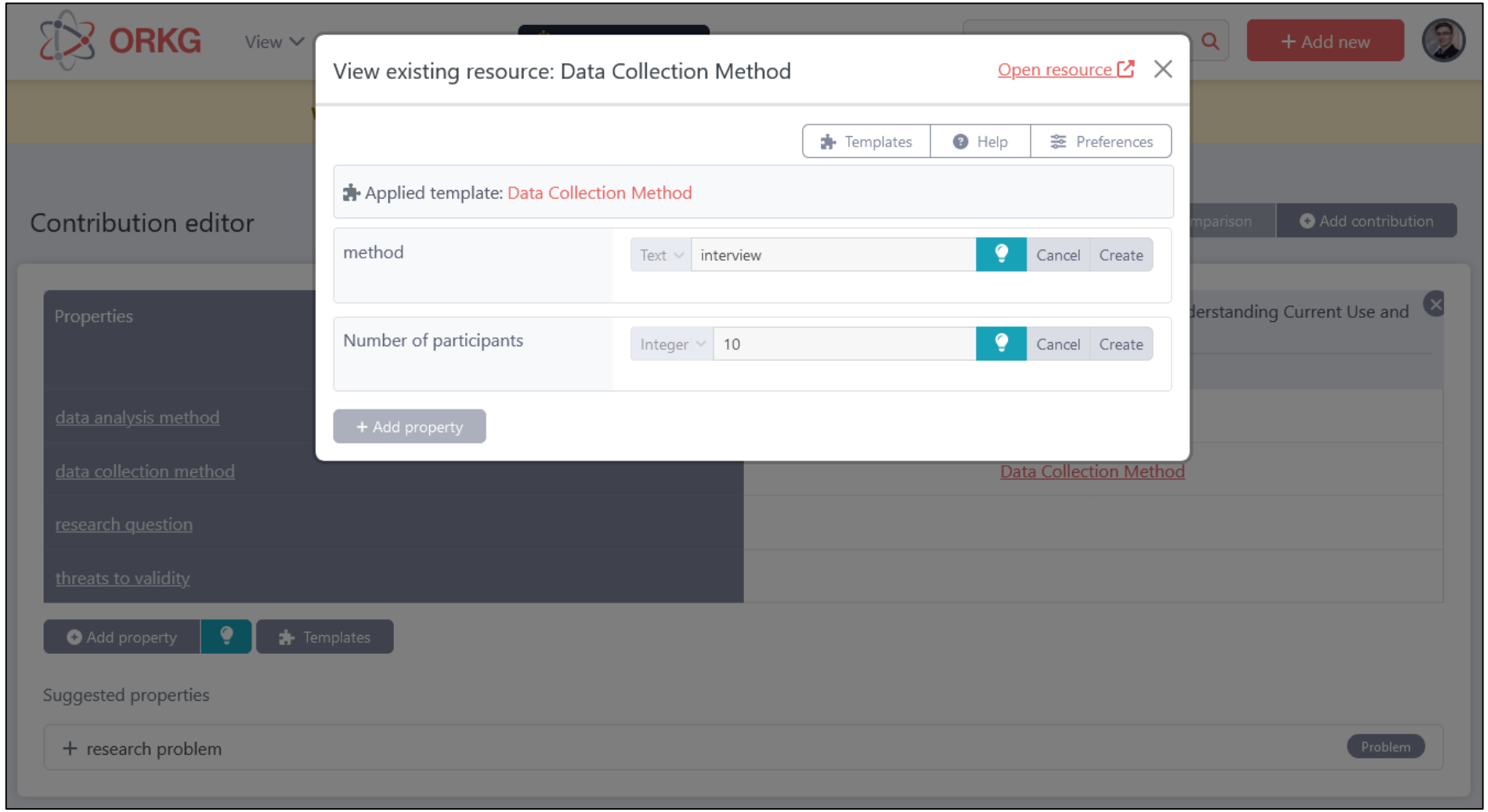
Otherwise, continue with the next property.

6. Describe a Paper: Enter the Data Collection Method(s)



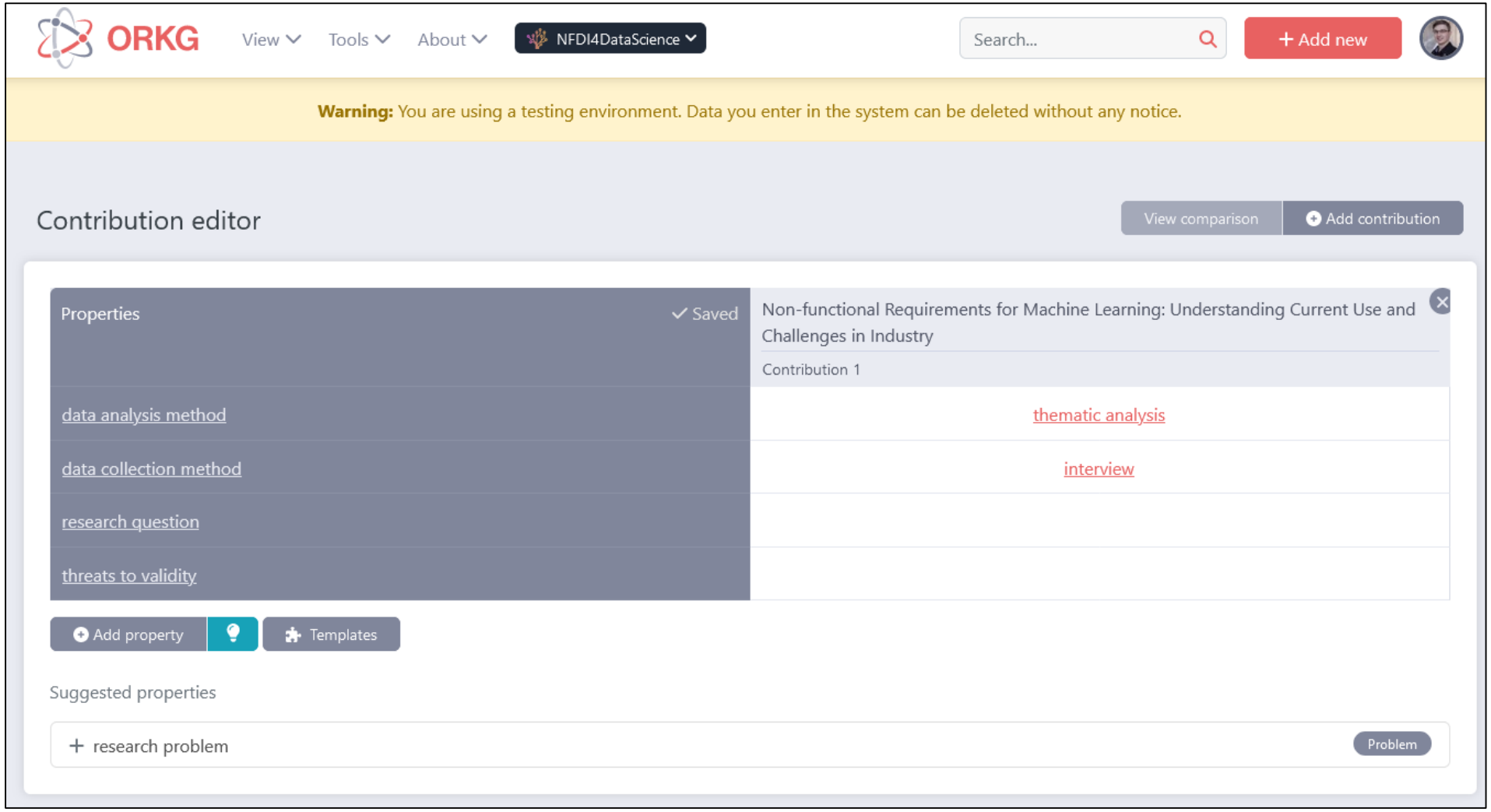
1. Click the +
2. Enter method
3. Click the +
4. Enter number of participants

6. Describe a Paper: Enter the Data Collection Method(s)



1. Click “Create”
2. Click “Create”
3. Close dialog

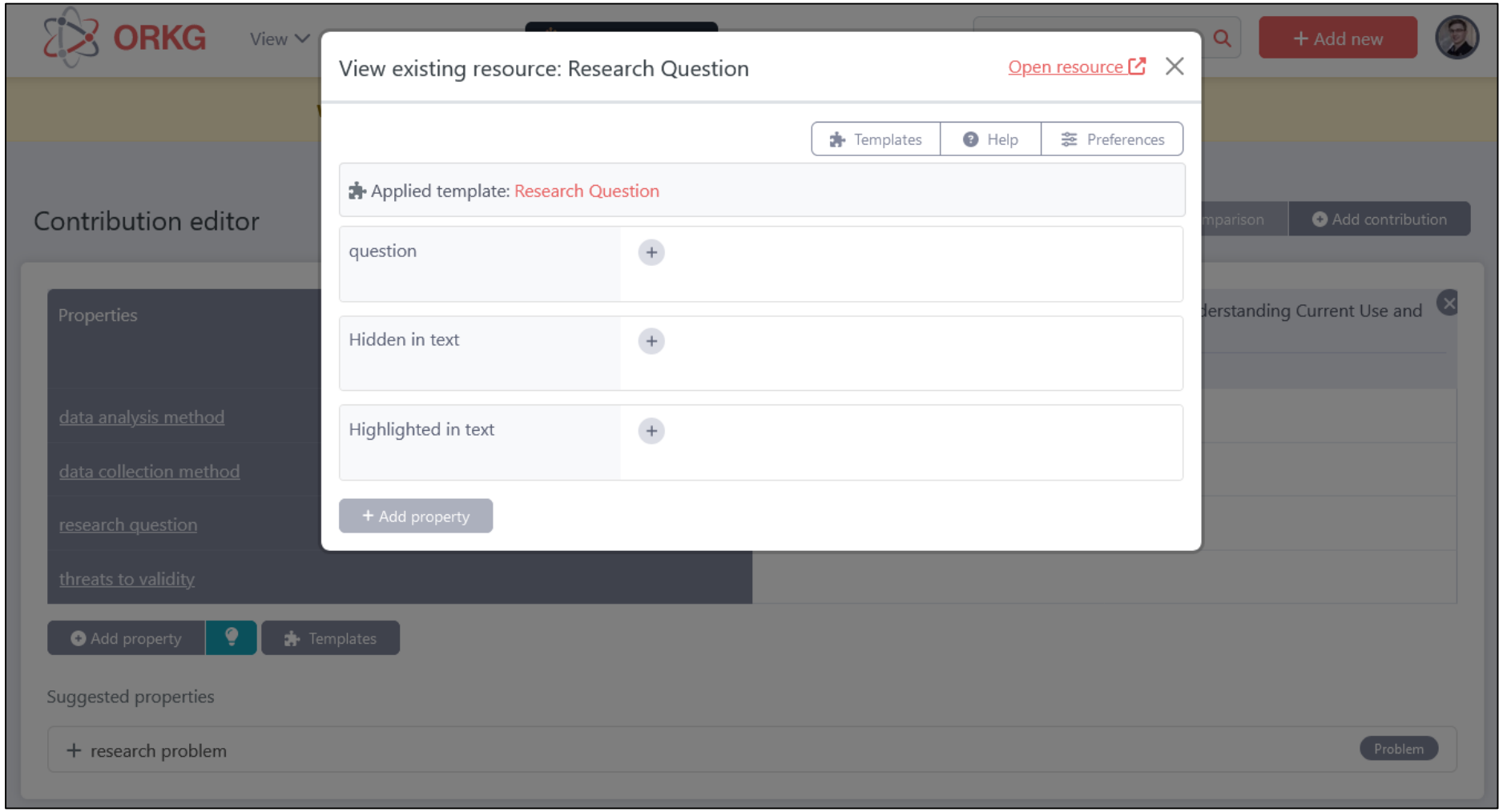
6. Describe a Paper: Enter the Data Collection Method(s)



If you have more collection methods, **repeat** the process.

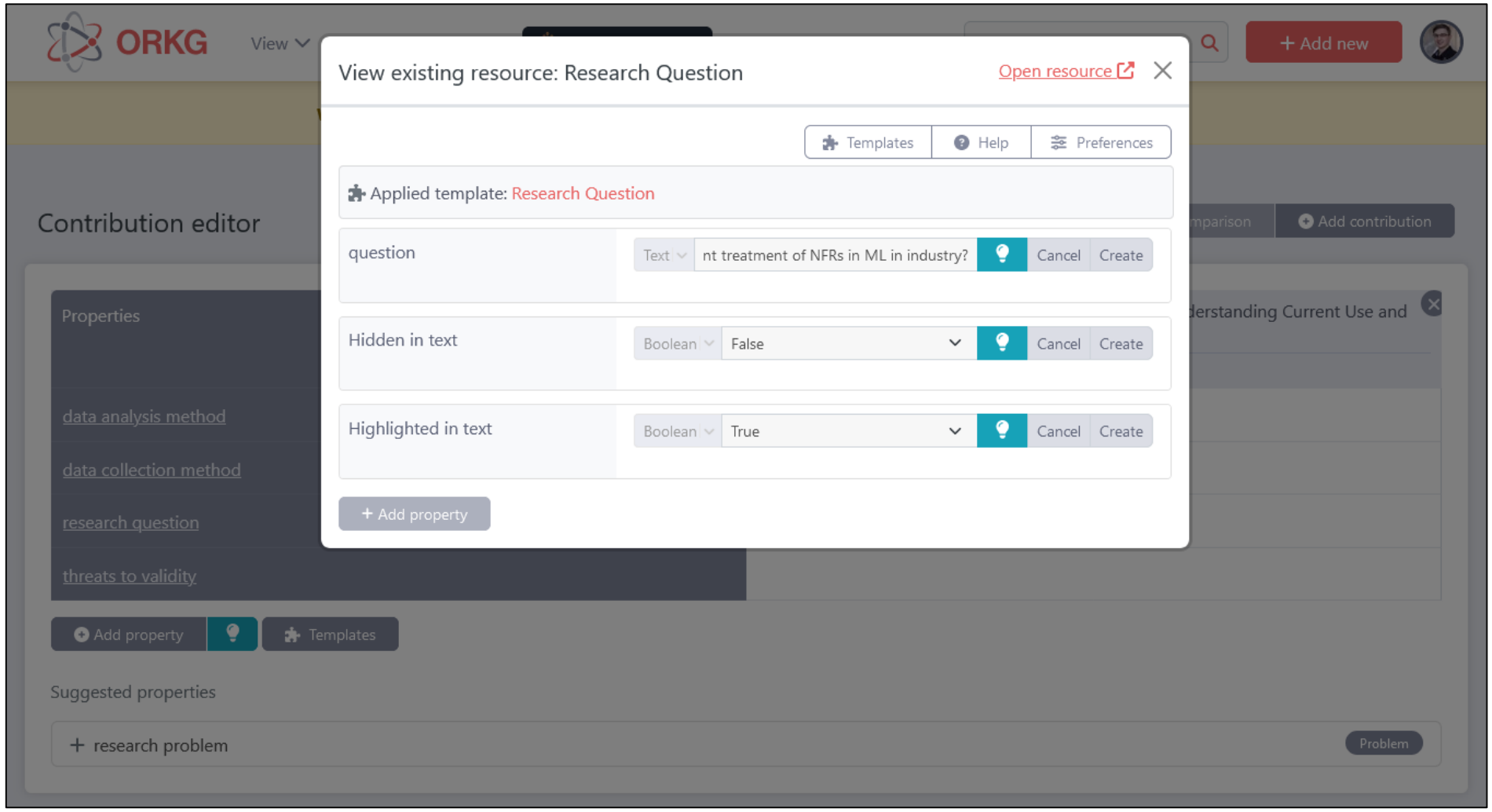
Otherwise, continue with the next property.

6. Describe a Paper: Enter the Research Question(s)



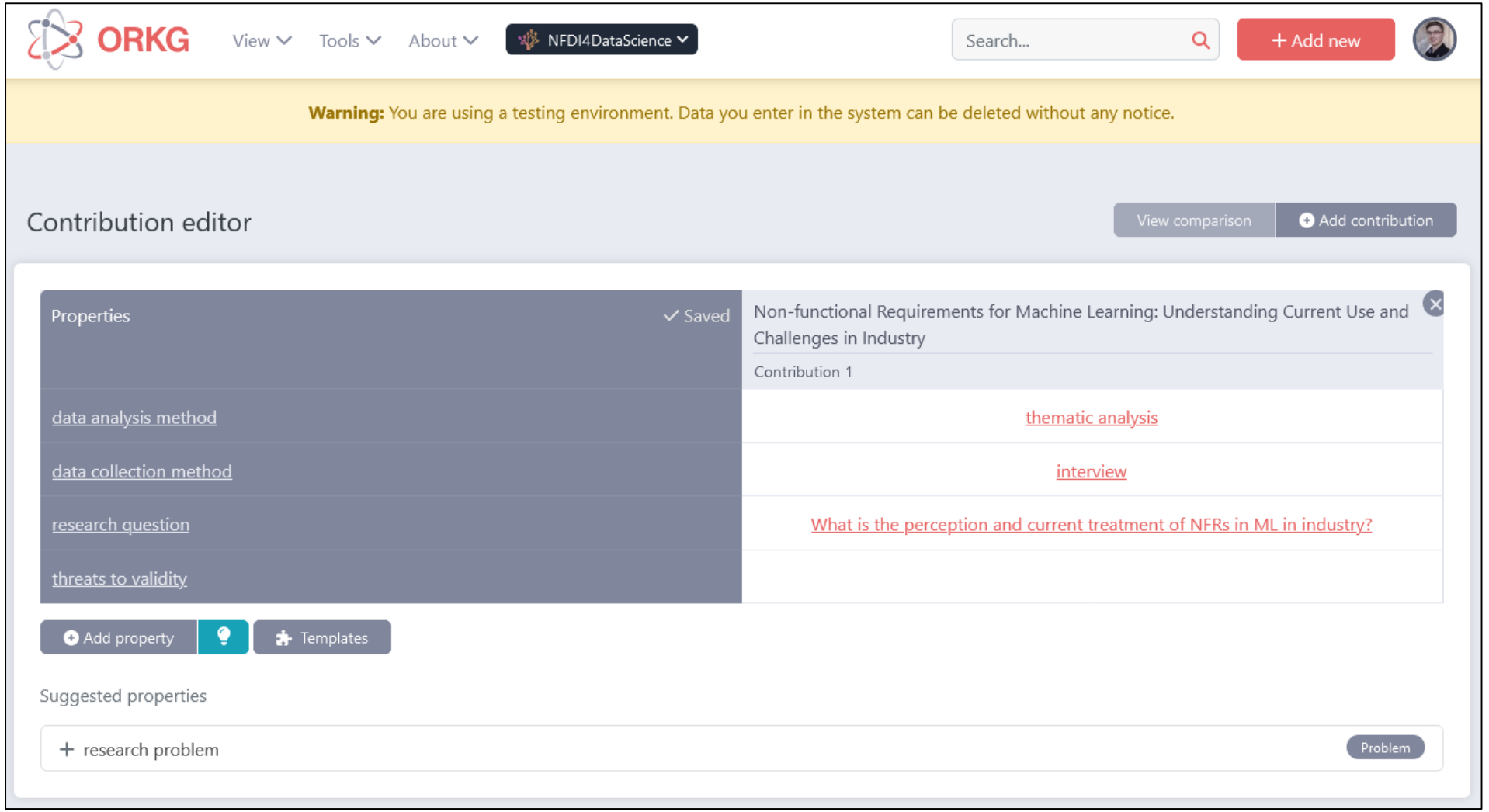
1. Click the ⊕
2. Enter question
3. Click the ⊕
4. Enter, if the question is hidden in text
5. Click the ⊕
6. Enter, if the question is highlighted in text

6. Describe a Paper: Enter the Research Question(s)



1. Click “Create”
2. Click “Create”
3. Click “Create”
4. Close dialog

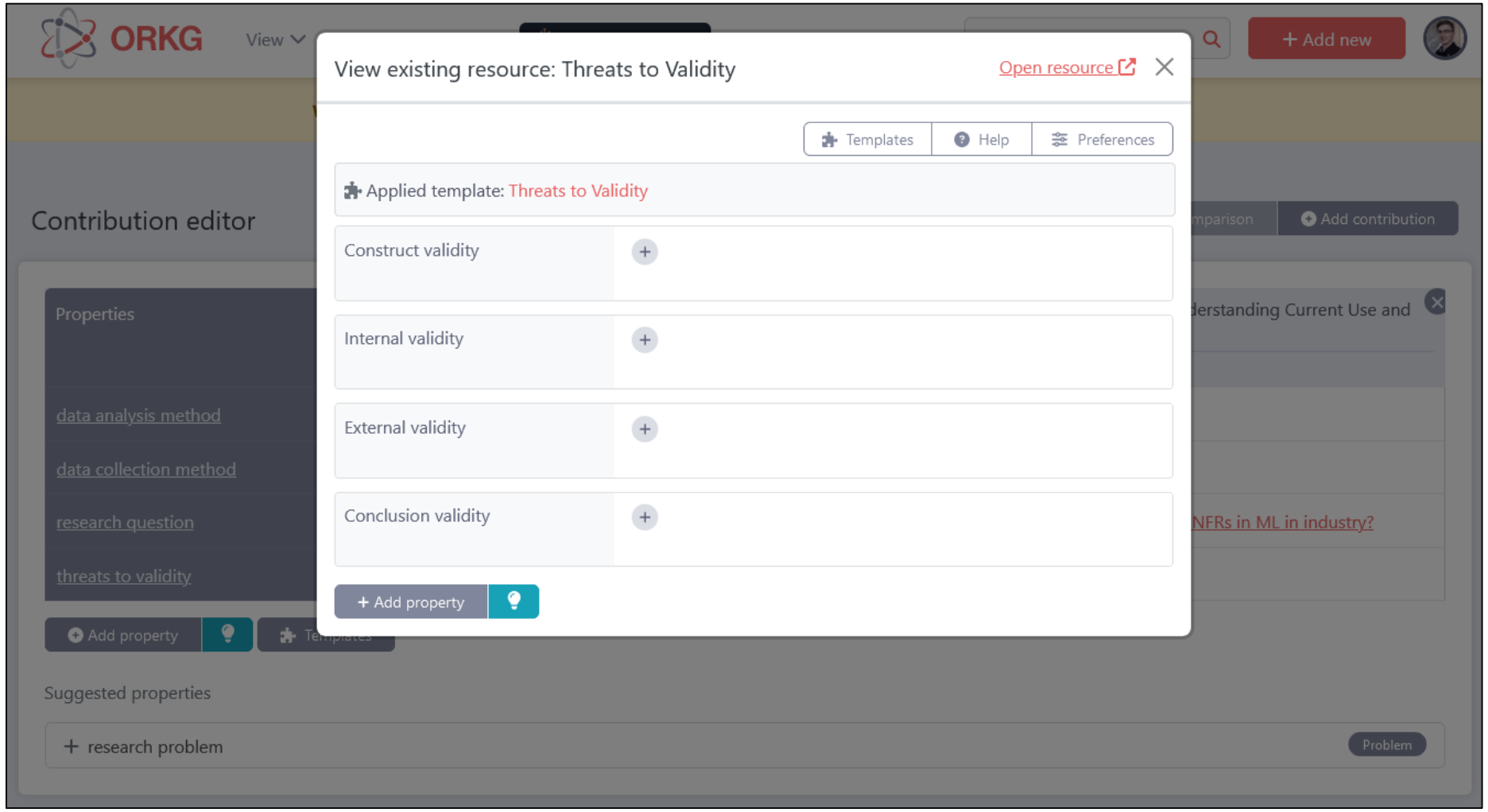
6. Describe a Paper: Enter the Research Question(s)



If you have more research questions, **repeat** the process.

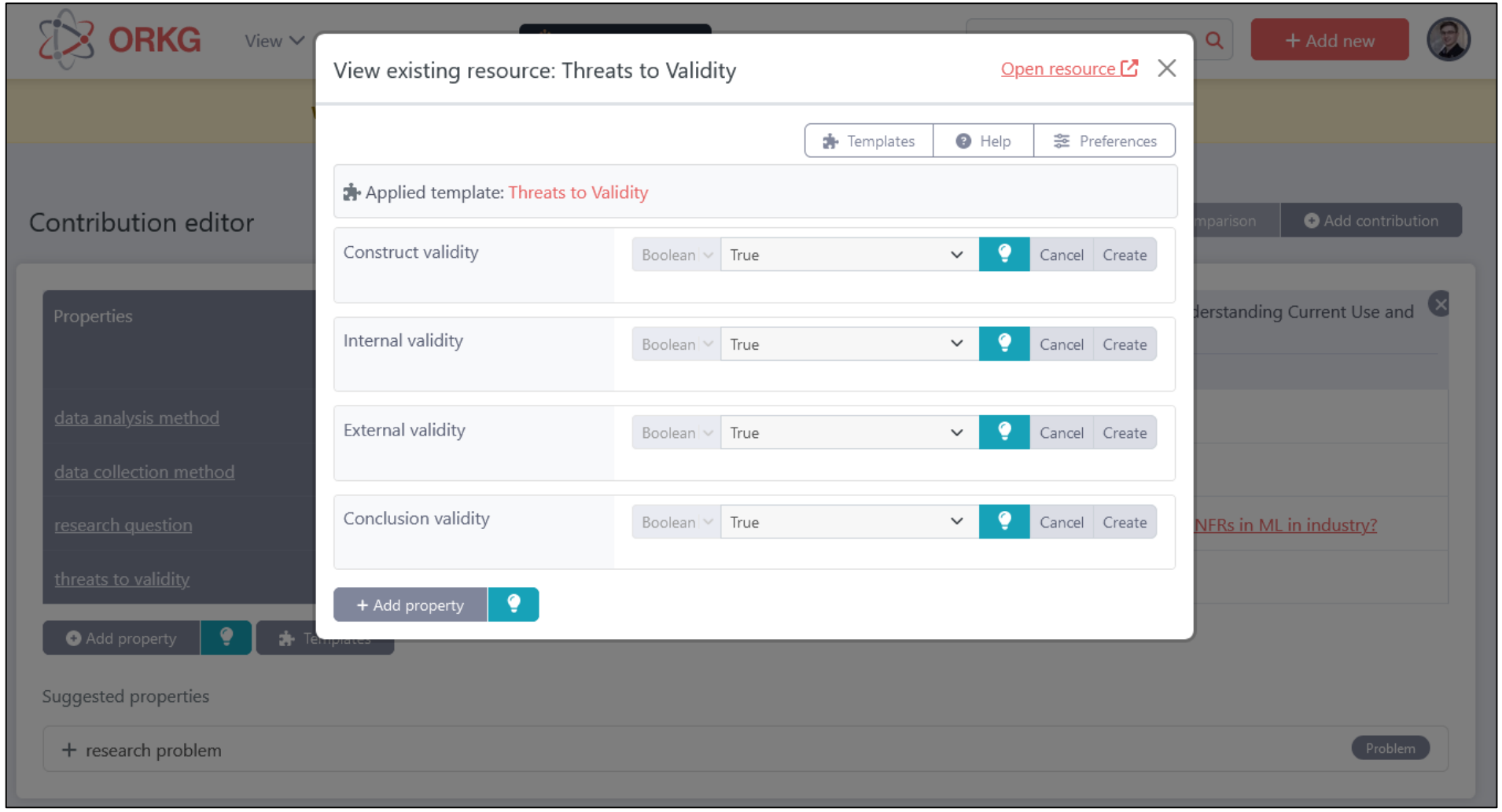
Otherwise, continue with the next property.

6. Describe a Paper: Enter the Threats to Validity



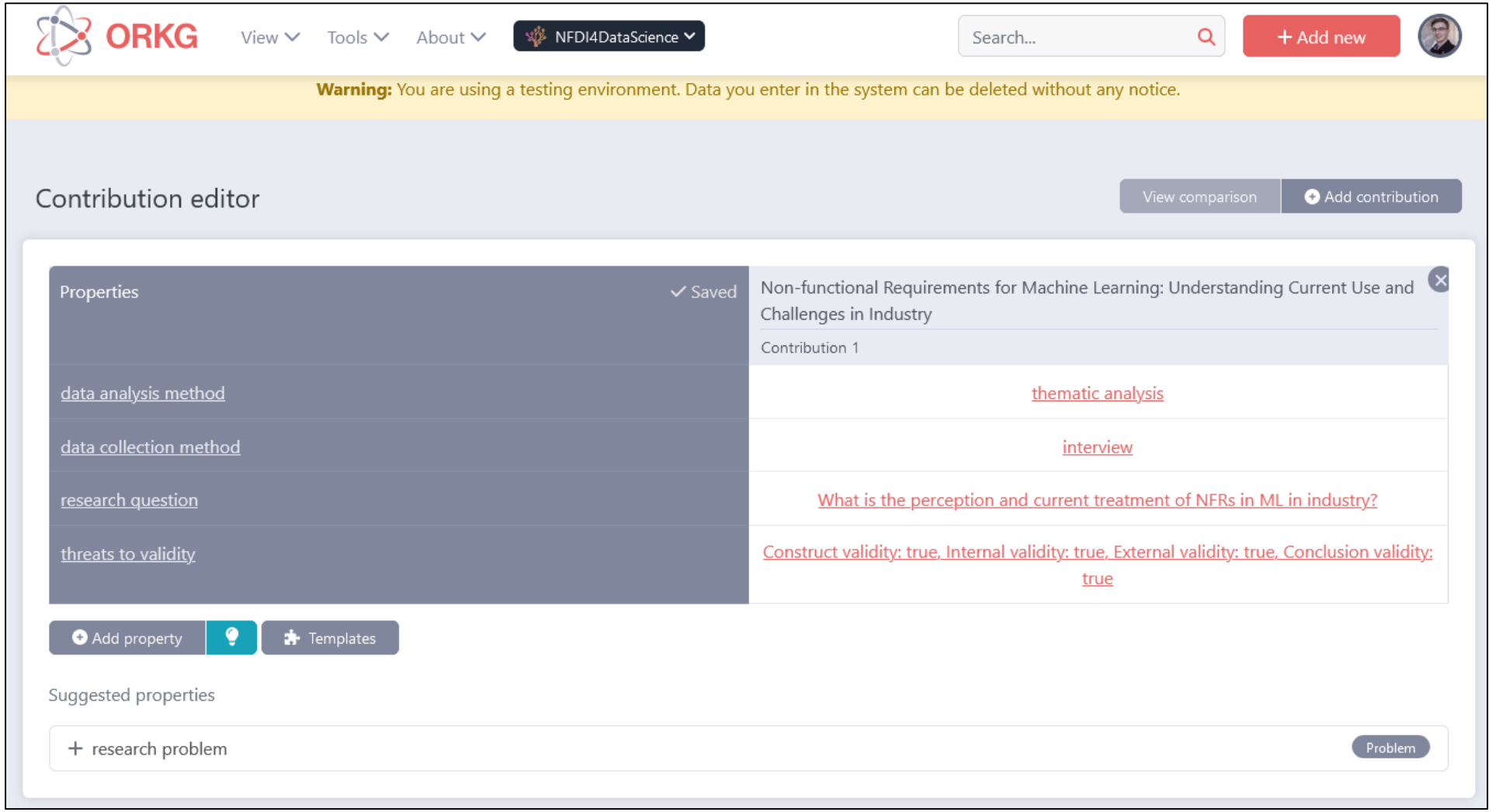
1. Click the ⊕
2. Enter construct validity
3. Click the ⊕
4. Enter internal validity
5. Click the ⊕
6. Enter external validity
7. Click the ⊕
8. Enter conclusion validity

6. Describe a Paper: Enter the Threats to Validity



1. Click “Create”
2. Click “Create”
3. Click “Create”
4. Click “Create”
5. Close dialog

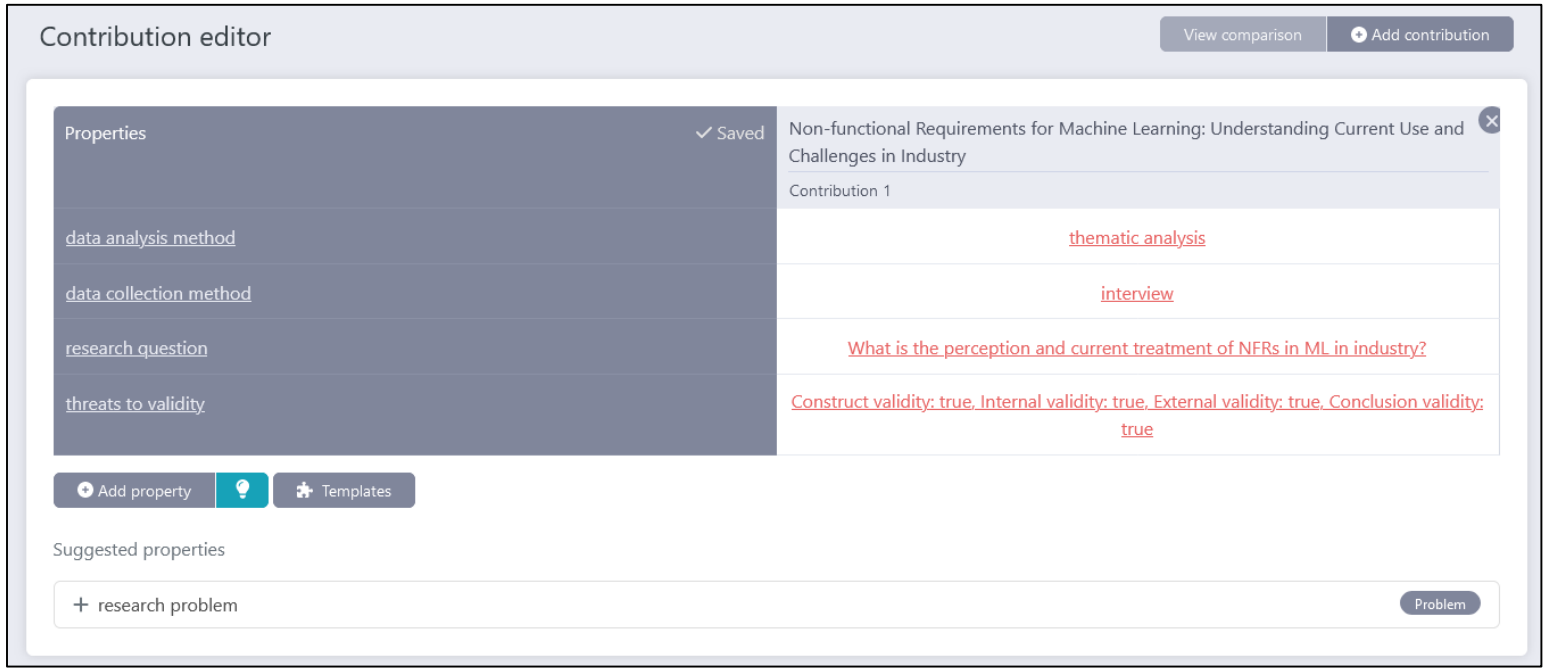
6. Describe a Paper: Enter the Threats to Validity



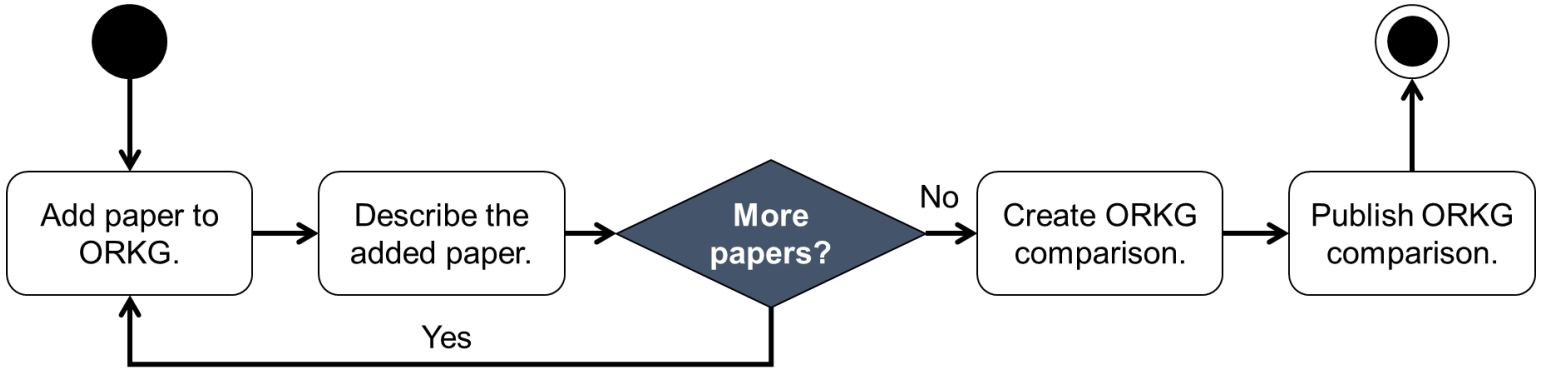
Now, we have described our first paper regarding its reported empirical research.

We can repeat the entire process for the next paper or work collaboratively!

7. Add the Next Paper

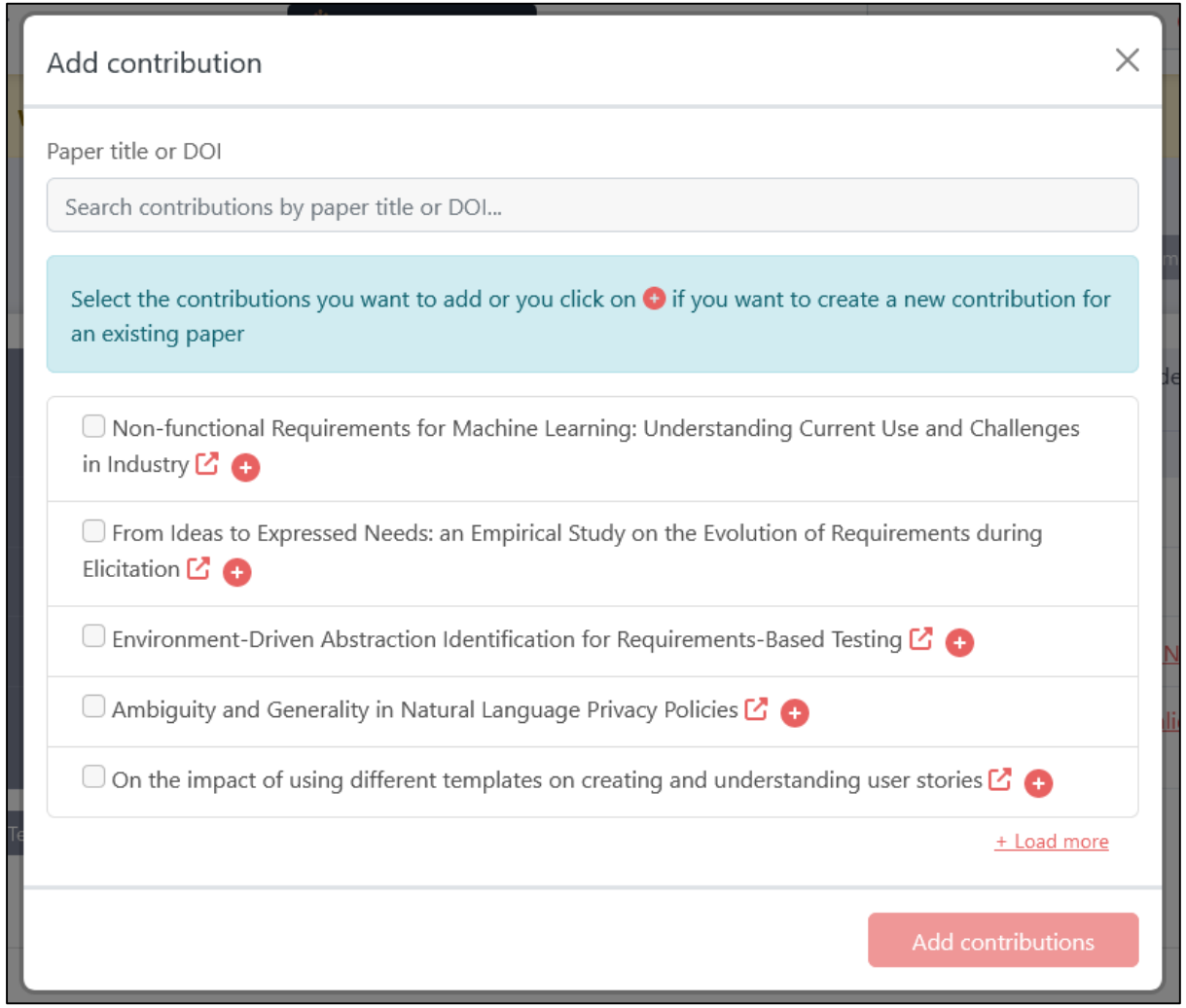


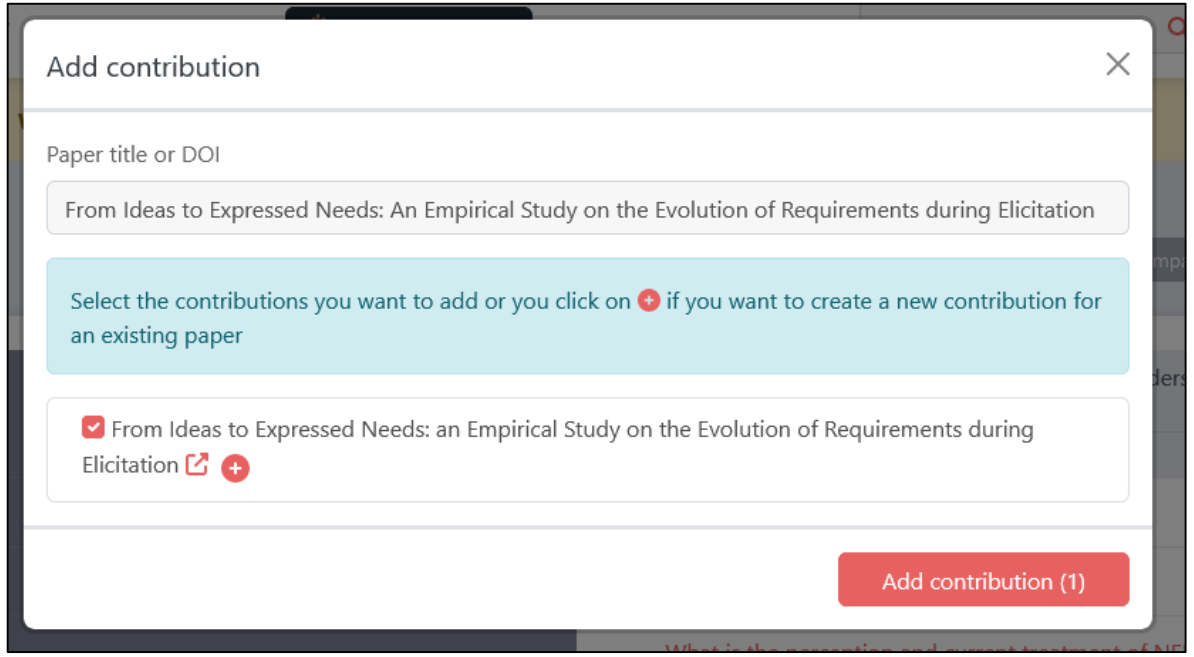
1. Click on “Add contribution”



Remark:
Now, we use a paper called “**From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation**” already described with the ORKG template.

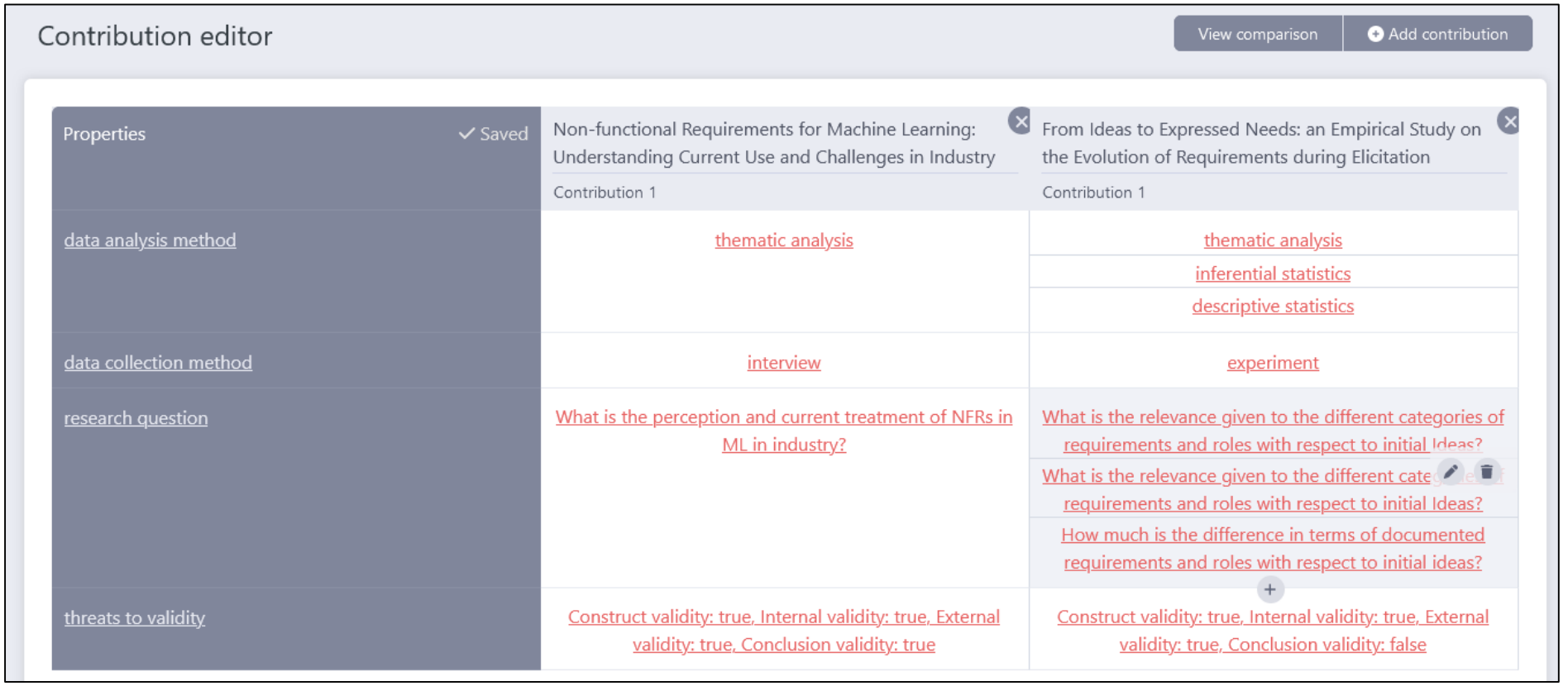
7. Add the Next Paper: Enter Paper Title





1. Enter paper title
2. Select the checkbox
3. Click “Add contribution (1)”

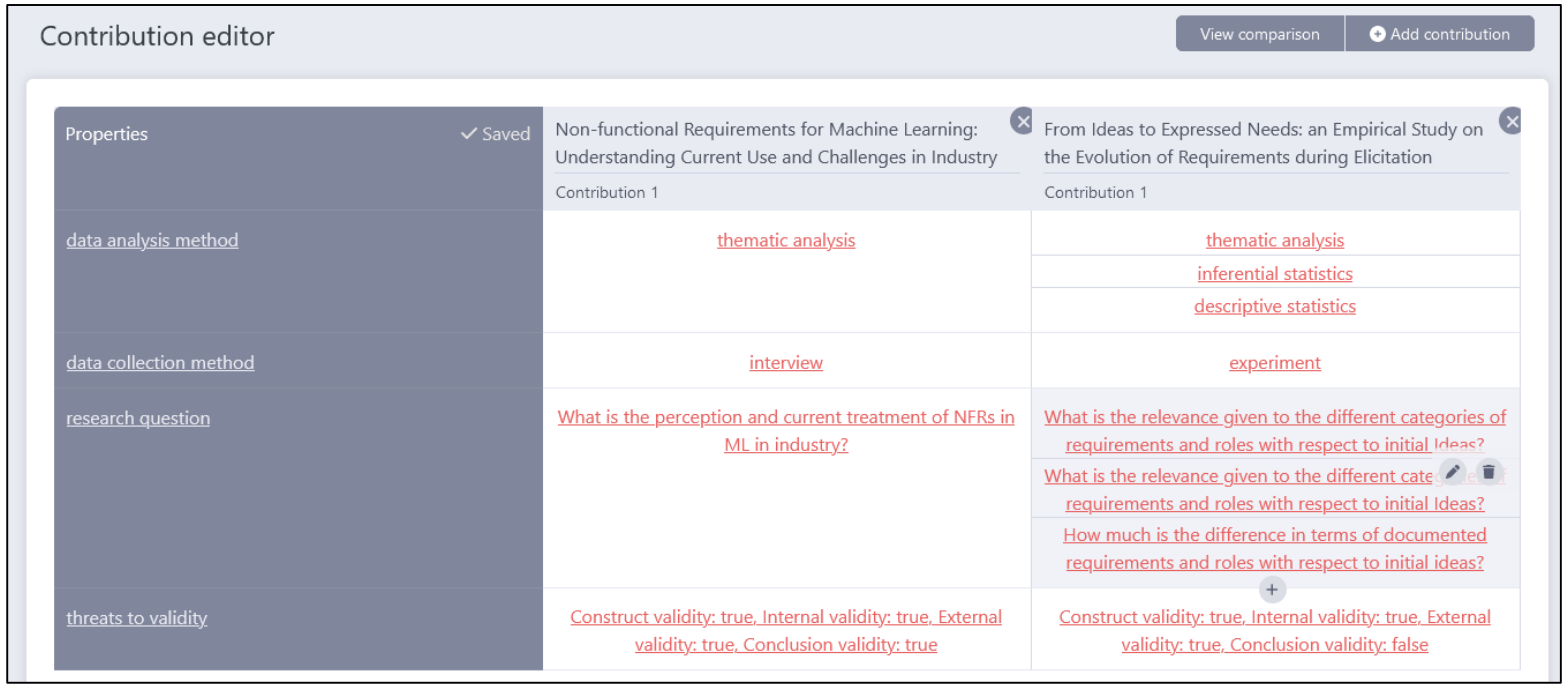
7. Add the Next Paper: Result



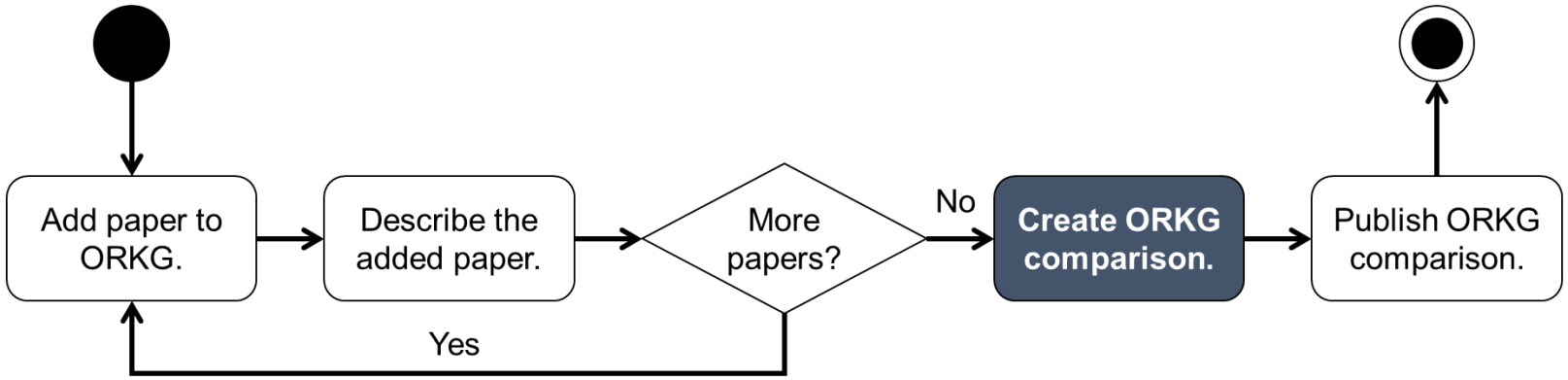
Now, we have two described papers.

If we want, we can add further ones or we can create an ORKG comparison.

8. Create ORKG Comparison



1. Click on “View comparison”



8. Create ORKG Comparison: Result and Improvements

Comparison | 2 contributions

Edit | + Add contribution | Visualize | Actions

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry *Contribution 1 - 2021*	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation *Contribution 1 - 2021*
data analysis method	Data Analysis Method	Data Analysis Method
		Data Analysis Method
		Data Analysis Method
data analysis method/data analysis method/method*	thematic analysis	descriptive statistics
		inferential statistics
		thematic analysis
data collection method	Data Collection Method	Data Collection Method
data collection method/data collection method		
↳ method*	interview	experiment
↳ number of participants*	10	30
research question	Research Question	Research Question
		Research Question
		Research Question
research question/research question		
↳ hidden in text*	✗	✗
		✗
		✗
↳ highlighted in text*	✓	✓
		✓
		✓
↳ question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
threats to validity	Threats to Validity	Threats to Validity
threats to validity/threats to validity		
↳ conclusion validity*	✓	✗
↳ construct validity*	✓	✓
↳ external validity*	✓	✓
↳ internal validity*	✓	✓

Now, we **created our ORKG comparison**.

Options before publishing the ORKG comparison:

1. Edit the ORKG comparison by ordering the rows

   Edit → Drag & Drop the property cells as required

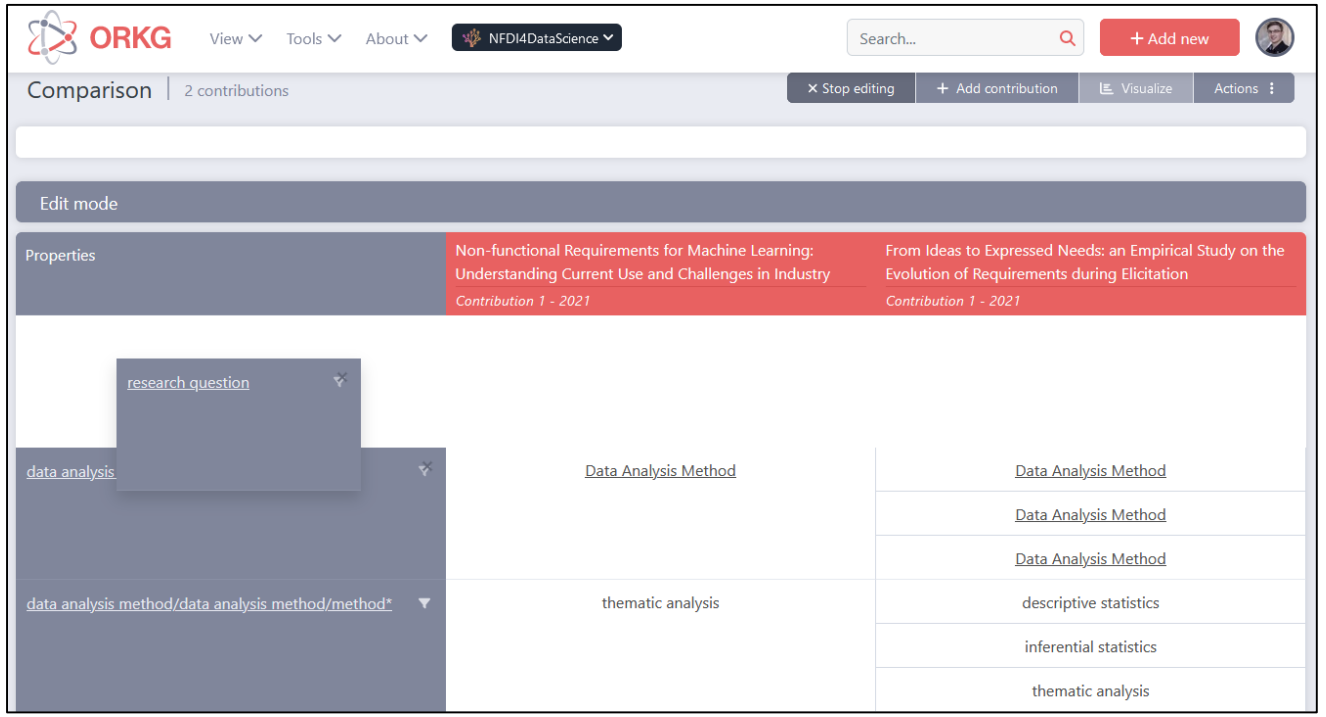
2. Select properties we want to show.

   Actions → Select properties → Disable checkboxes of properties to hide

3. Save ORKG comparison as a draft for later

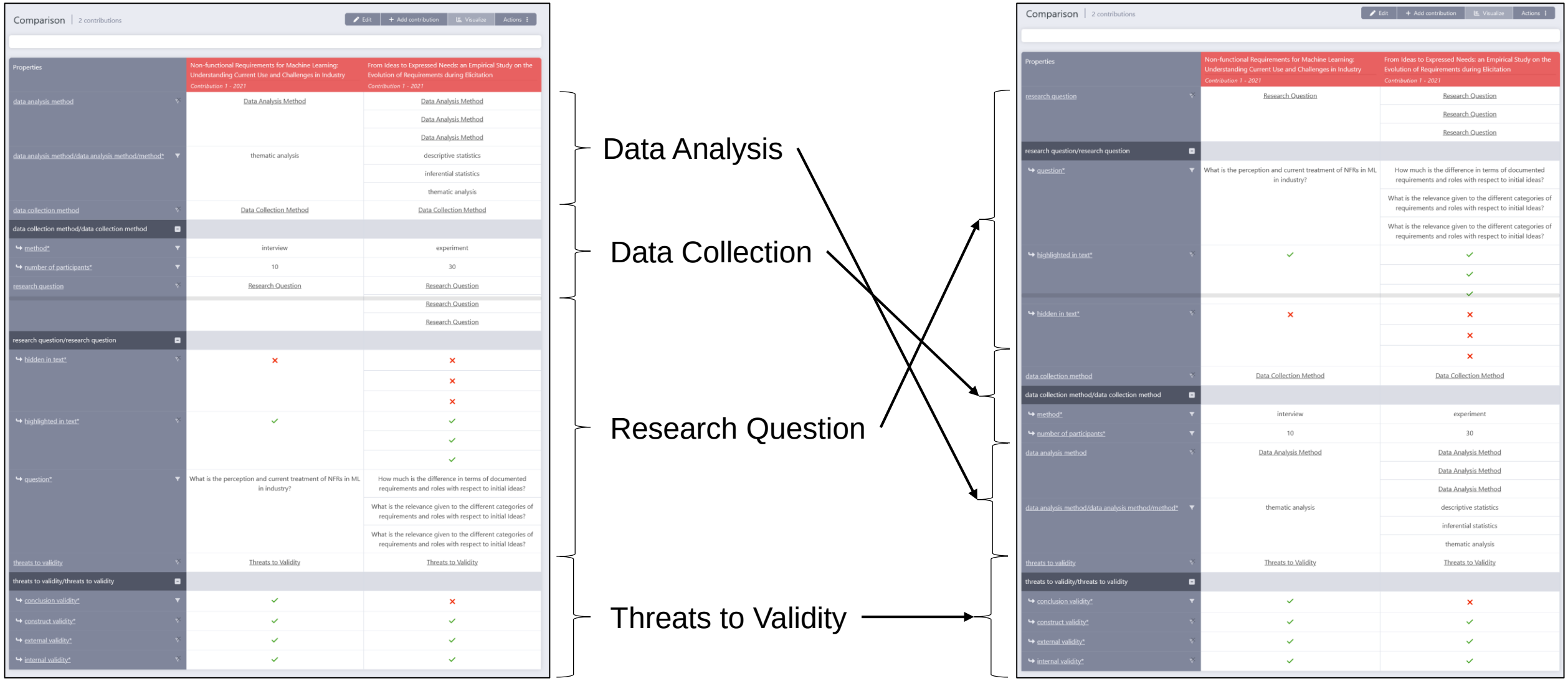
   Actions → Save as draft → Enter title → Save → Draft in “My account”

9. Improve ORKG Comparison: Order Rows

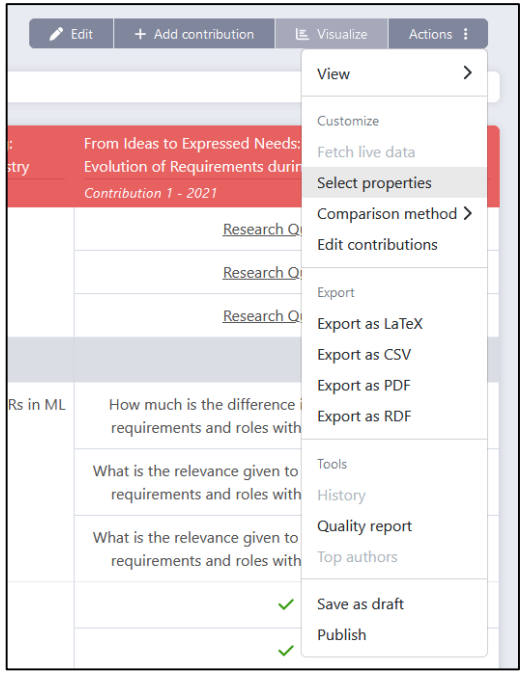


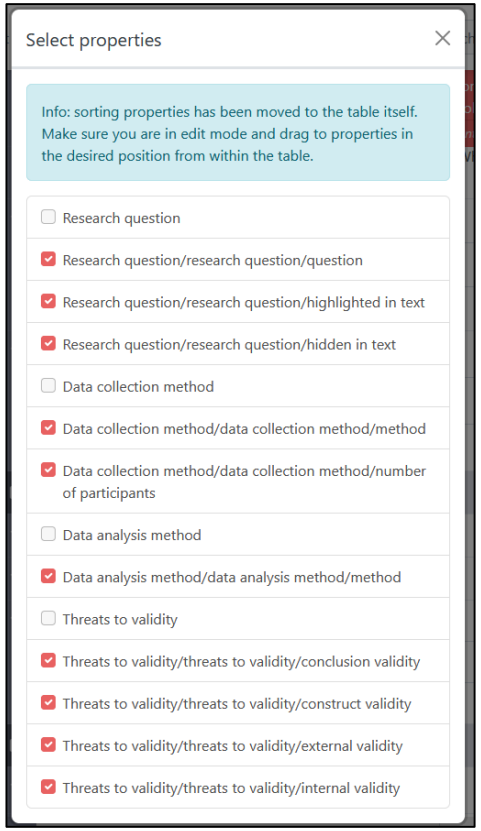
1. Click on “Edit”
2. Click on the grey property cell you want to move
3. Drag & Drop the property cell where you want

9. Improve ORKG Comparison: Order Rows – Result



9. Improve ORKG Comparison: Select Properties





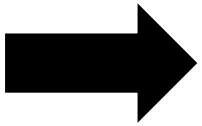
1. Click on “Actions”
2. Click on “Select properties”
3. Disable all checkboxes of properties you want to hide
4. Close dialog

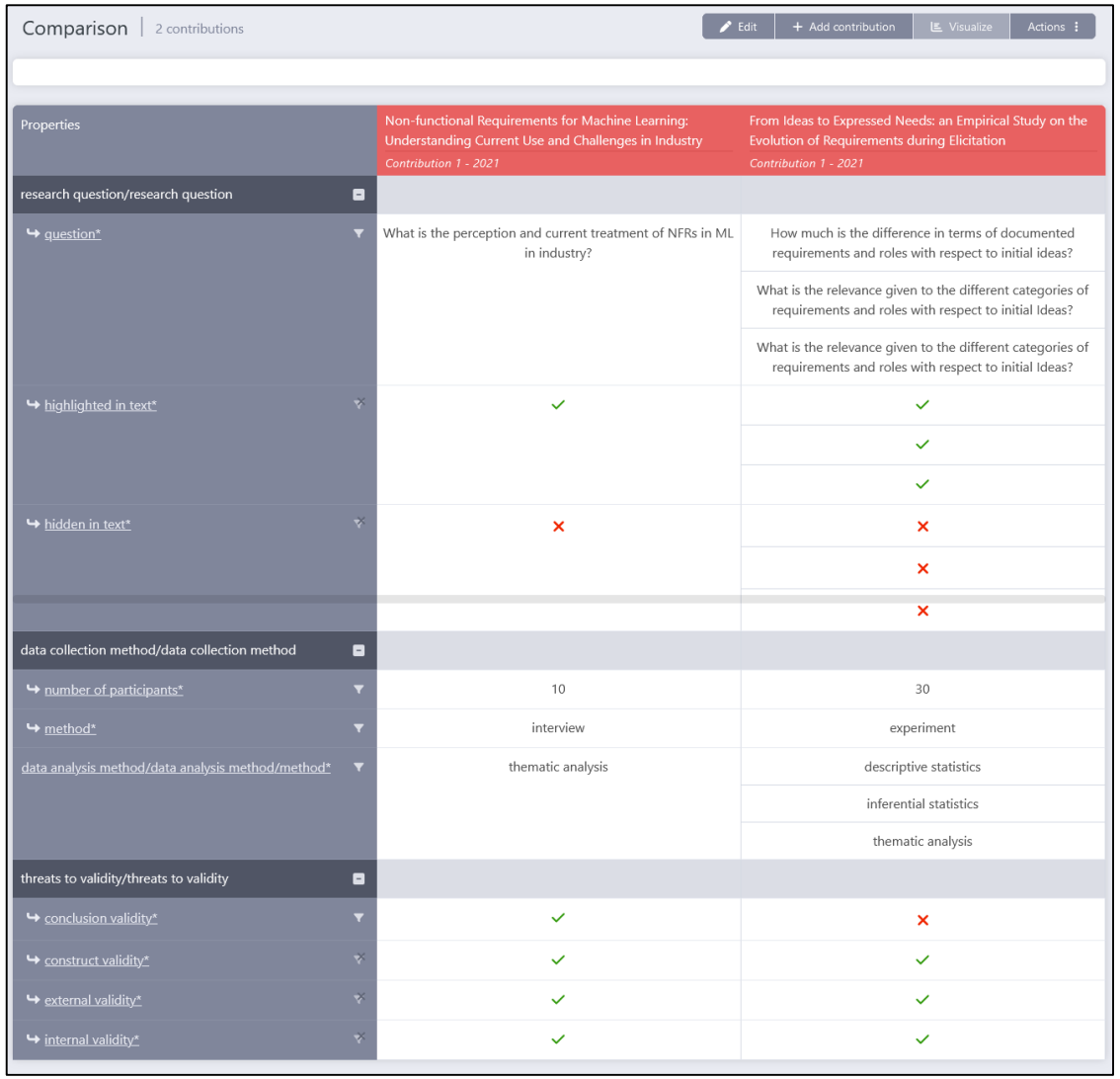
9. Improve ORKG Comparison: Select Properties – Result

Comparison | 2 contributions

Edit | + Add contribution | Visualize | Actions

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry *Contribution 1 - 2021*	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation *Contribution 1 - 2021*
research question	Research Question	Research Question
		Research Question
		Research Question
research question/research question		
question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
highlighted in text*	✓	✓
		✓
		✓
hidden in text*	✗	✗
		✗
		✗
data collection method	Data Collection Method	Data Collection Method
data collection method/data collection method		
method*	interview	experiment
number of participants*	10	30
data analysis method	Data Analysis Method	Data Analysis Method
		Data Analysis Method
		Data Analysis Method
data analysis method/data analysis method/method*	thematic analysis	descriptive statistics
		inferential statistics
		thematic analysis
threats to validity	Threats to Validity	Threats to Validity
threats to validity/threats to validity		
conclusion validity*	✓	✗
construct validity*	✓	✓
external validity*	✓	✓
internal validity*	✓	✓



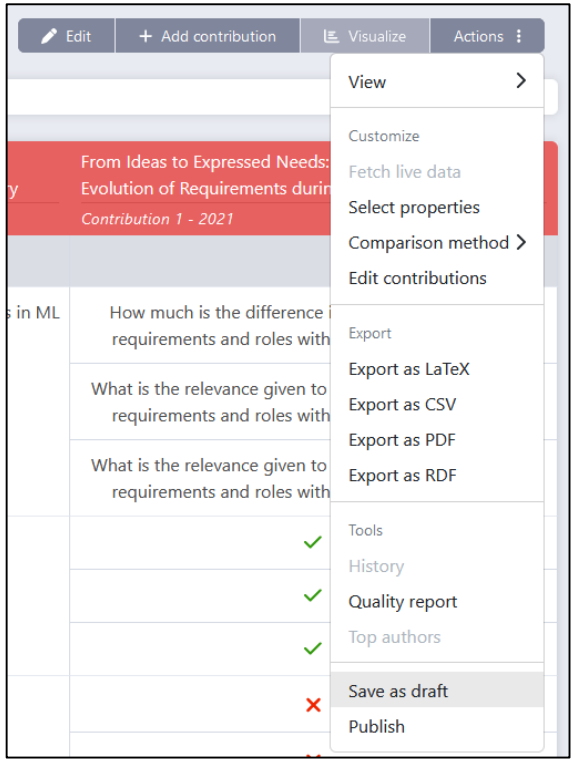


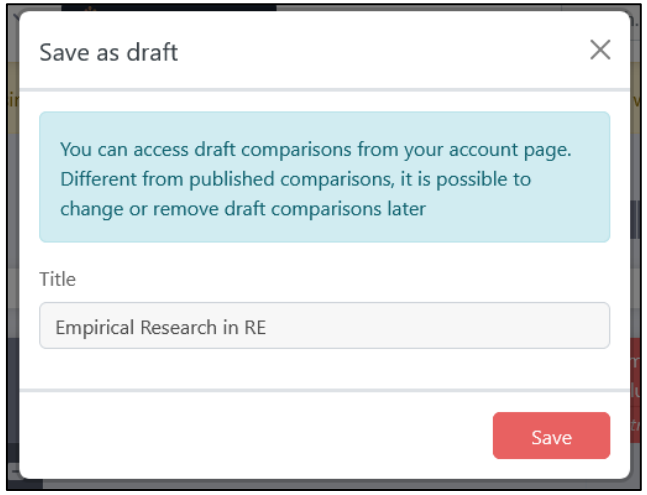
Comparison | 2 contributions

Edit | + Add contribution | Visualize | Actions

Properties	Non-functional Requirements for Machine Learning: Understanding Current Use and Challenges in Industry *Contribution 1 - 2021*	From Ideas to Expressed Needs: an Empirical Study on the Evolution of Requirements during Elicitation *Contribution 1 - 2021*
research question/research question		
question*	What is the perception and current treatment of NFRs in ML in industry?	How much is the difference in terms of documented requirements and roles with respect to initial ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
		What is the relevance given to the different categories of requirements and roles with respect to initial Ideas?
highlighted in text*	✓	✓
		✓
		✓
hidden in text*	✗	✗
		✗
		✗
data collection method/data collection method		
number of participants*	10	30
method*	interview	experiment
data analysis method/data analysis method/method*	thematic analysis	descriptive statistics
		inferential statistics
		thematic analysis
threats to validity/threats to validity		
conclusion validity*	✓	✗
construct validity*	✓	✓
external validity*	✓	✓
internal validity*	✓	✓

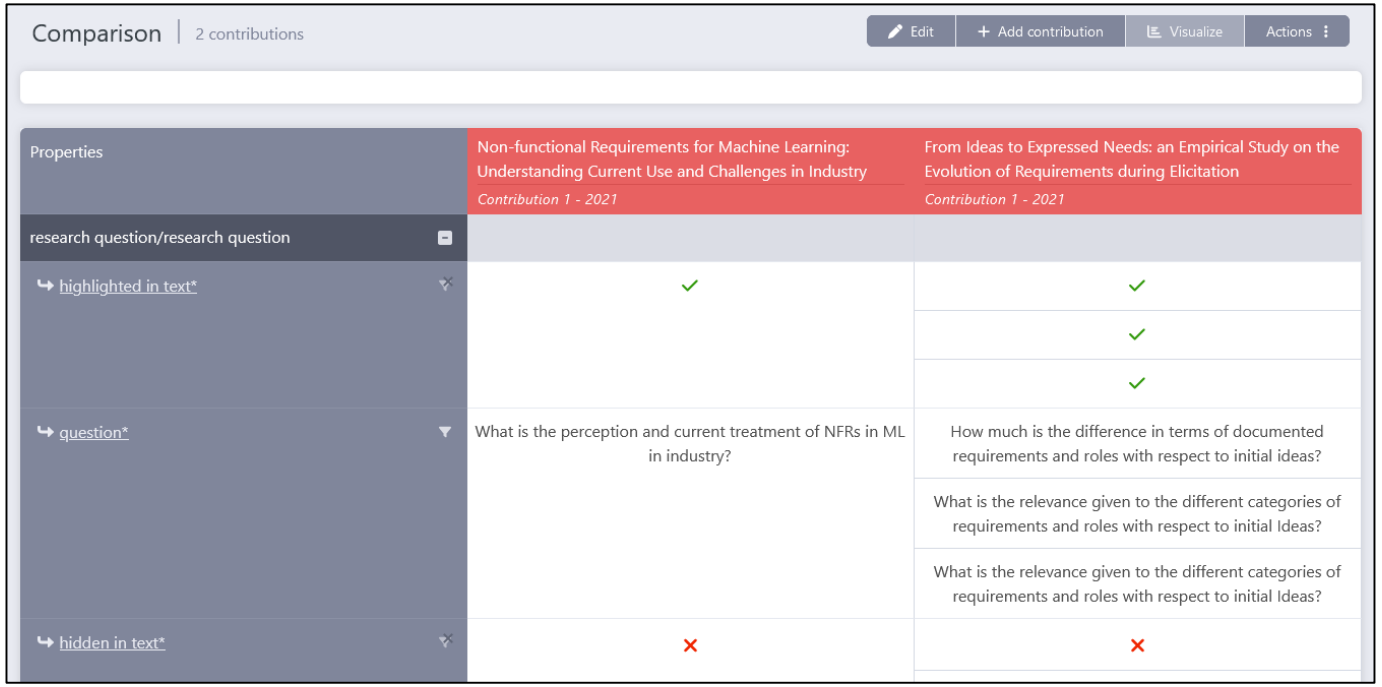
9. Improve ORKG Comparison: Save as Draft

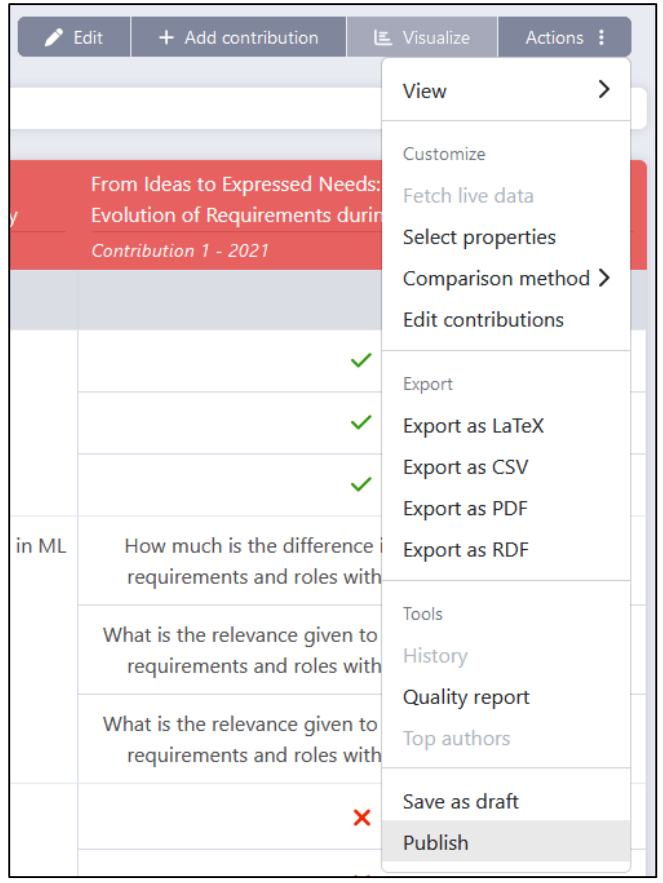


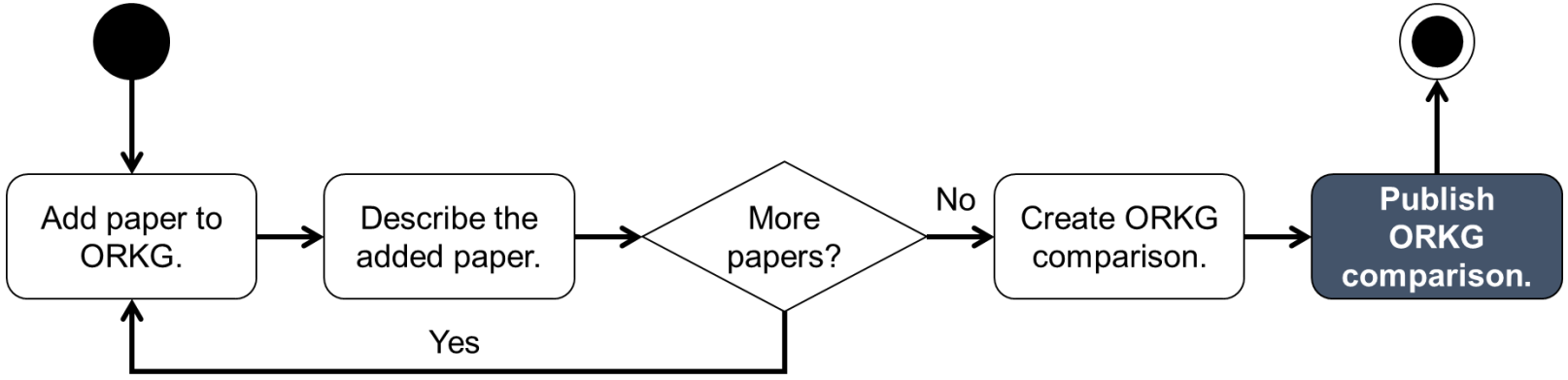


1. Click on “Actions”
2. Click on “Save as draft”
3. Enter a title and click on “Save”
4. The draft is saved in your account

10. Publish ORKG Comparison

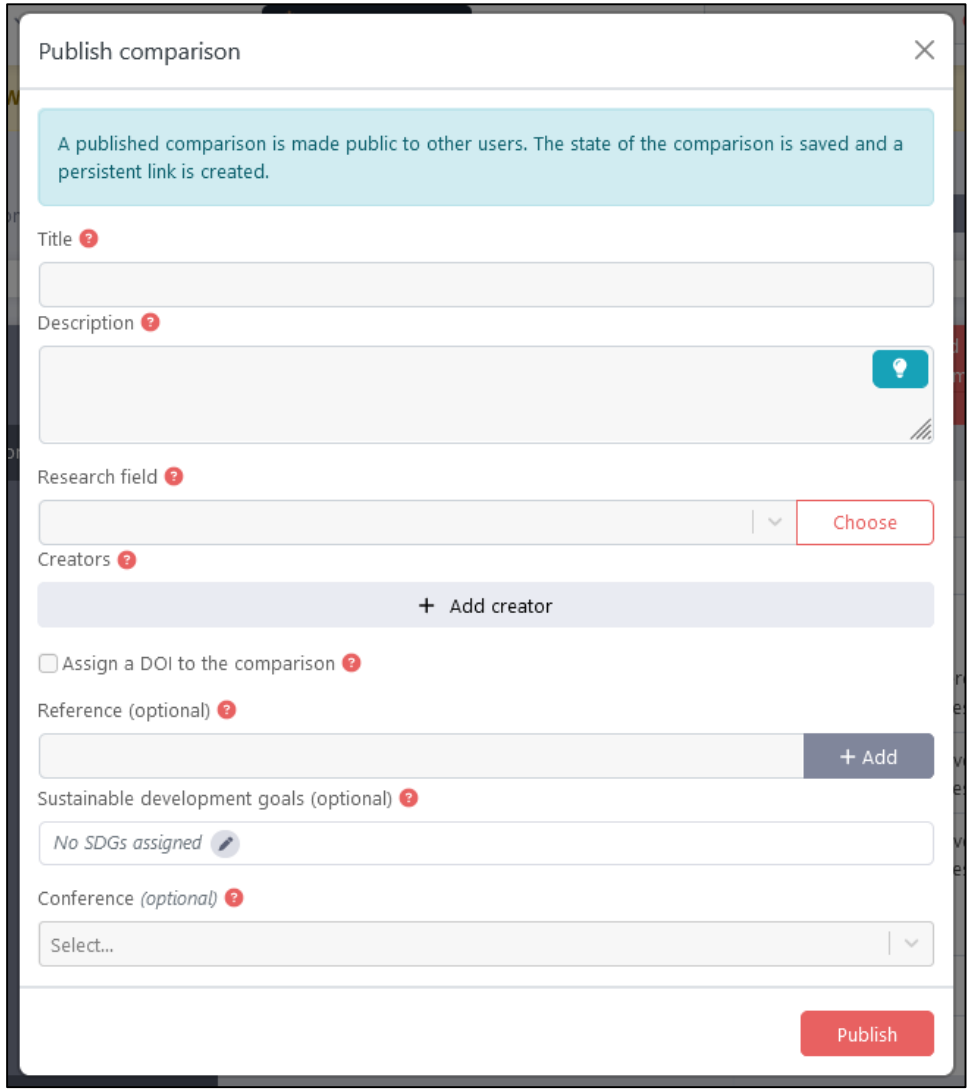






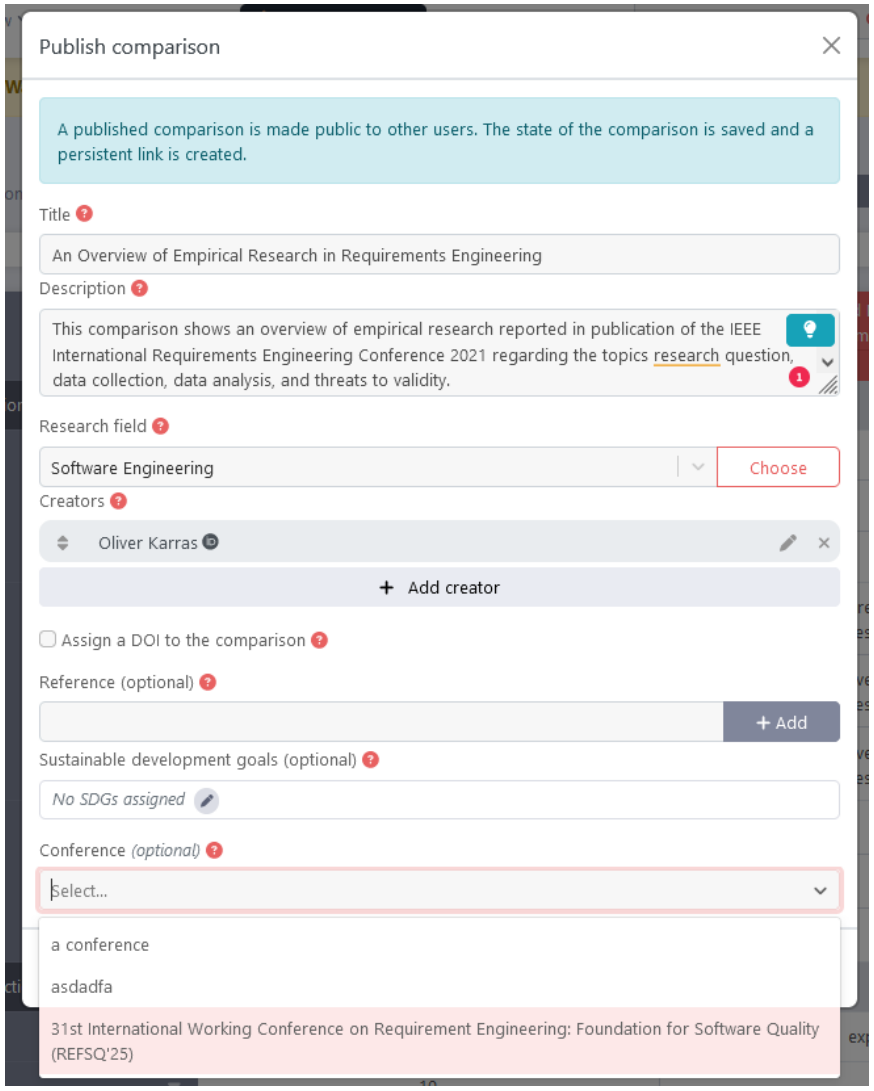
1. Click on “Actions”
2. Click on “Publish”

10. Publish ORKG Comparison

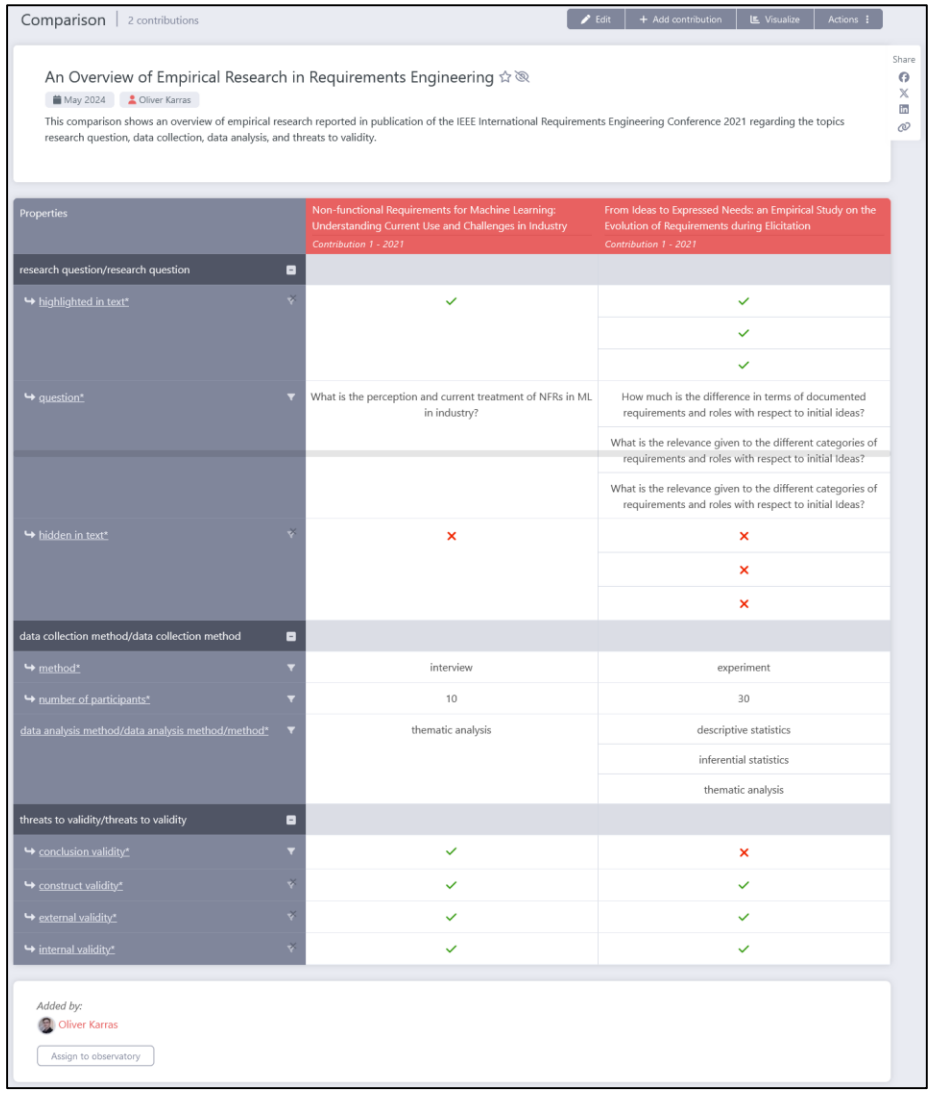


1. Fill out the dialog
2. Click on “Publish”

Remark:
You can add
- A **DOI** for citation (can also be done later)
- Additional **References**
- Related **Sustainable development goals**
- ORKG partner **Conferences**, such as **REFSQ’25**, that award the **Best ORKG Comparison Award**



10. Publish ORKG Comparison: Result



Now, we **published our ORKG comparison**, a stable version that can be maintained, extended, updated, and published as new versions.

Options after publishing the ORKG comparison:

1. Add visualizations
2. Add DOI later and export citation
3. Use the quality report to get feedback from other researchers
4. Fetch live data for a new draft or published version
5. Fetch data for later analysis with different interfaces

Remark:
These options are only demonstrated live in the tutorial. If you need help, do not hesitate to contact the ORKG team, especially **Oliver Karras** (oliver.karras@tib.eu).